

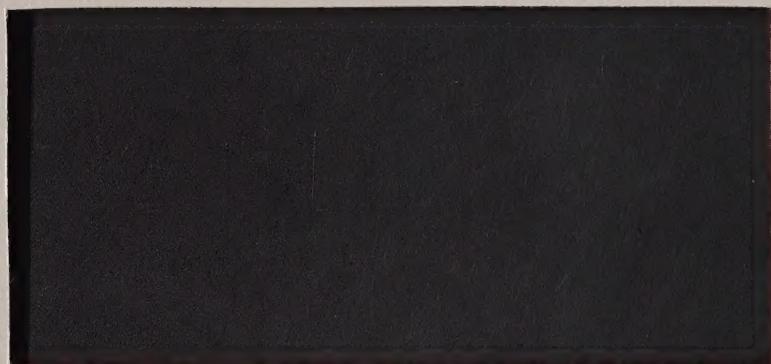
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**Tracor Instruments**



TRACOR RUDMOSE  
ARJ-4C/6  
AUTOMATIC RECORDING  
AUDIOMETER

SERVICE MANUAL

19470H

Serial Number \_\_\_\_\_

May 1982

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**Tracor Instruments**

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9. This warranty shall be governed by the laws of Texas.

## Tracor Instruments

**Medical Division**

Tracor, Inc. 6500 Tracor Lane Austin, Texas 78721 Telephone 512:926-2800

## ADDENDUM

Some six frequency Model ARJ-4C self recording automatic audiometers are specially calibrated for a hearing level range of 0 to 100 dB HL rather than the normal factory range of -10 to 90 dB HL. Units so modified are labeled as such on the identification plate. These units use Tracor audiogram card part number 18563-0001.

The modification is performed on the audio PCB assembly Tracor part number 19475. Resistors R42 and R43 are factory selected to provide the 0 to 100 dB HL range.



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## SECTION I

### GENERAL DESCRIPTION

#### INTRODUCTION

The Tracor Rudmose ARJ-4C Automatic Recording Audiometer (figure 1) is a discrete frequency Bekesy audiometer which automatically (or manually) records an individual's pure tone air conduction thresholds on an audiogram card. Special audiological training is not required to operate the Rudmose ARJ-4C. Once the test has begun, it may continue without further attention or supervision. The test may be interrupted by the operator or presented manually (as opposed to automatically) at any time. The operator is always in control of the audiometric examination.



Figure 1 Rudmose ARJ-4C Automatic Recording Audiometer

The subject responds to the test (1) BY PRESSING A HAND SWITCH BUTTON DURING THE PERIOD OF TIME HE CAN HEAR THE PURE TONE SIGNAL AND (2) BY RELEASING THE HAND SWITCH DURING THE PERIOD OF TIME HE CANNOT HEAR THE TONE SIGNAL. The subject faces a card in the test booth which instructs him to "PRESS WHEN YOU . . . RELEASE WHEN YOU DON'T". While the handswitch is depressed, the test tone stimulus steadily decreases in level at the rate of 5 dB per second. When he releases, the test tone stimulus increases in level at the same rate until the subject again hears the tone and presses the handswitch. Every 30 seconds the audiometer automatically switches to another test frequency. When one ear has been tested, the test tones are presented automatically in the same sequence to the opposite ear. The subject continues this PRESS-RELEASE response throughout the seven-minute test, during which time both ears are tested separately at seven frequencies covering the range of 500 to 8000 Hz.

Two versions of the ARJ-4C are available: ARJ-4C/6 and ARJ-4C/7, with six and seven frequency respectively. The ARJ-4C/6 performs a six minute test, covering the range of 500 through 6000 Hz. In addition, the ARJ-4C/7 performs a seven minute test, covering the range of 500 through 8000 Hz.

Care must be exercised to use the proper audiogram card. The ARJ-4C/6 uses audiogram card part number 19171 and the ARJ-4C/7 uses part number 19571. Audiogram cards are available with or without medical history form on back of card. Dash number (-0001) indicates printing on back. Dash number (-0002) indicates no printing on back.

Every response the subject makes during his examination, typically 150 threshold crossings, is automatically recorded without the possibility of operator error. Audiometric results are automatically printed with a nylon cord tip pen on a 4-inch by 9-inch card which is synchronized in frequency with the test tone being presented. These cards may be reused (recording in a different color) for tests of comparison or reliability. Different colored pens may be ordered from Tracor Instruments, Austin, Texas.

#### OPERATING CONTROLS AND INDICATORS

Following is a list by name and function of the operating controls and indicators for the ARJ-4C.

TABLE 1-1  
OPERATING CONTROLS AND INDICATORS

| <u>Name</u>      | <u>Function</u>                                                                                                                                                                                                 |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PWR ON/OFF       | Applies power to audiometer in ON position, (red light).                                                                                                                                                        |
| TEST Switch      | Starts testing which continues until test is completed or stopped by depressing TEST switch again.                                                                                                              |
| TRIAL Switch     | Stops table travel only, allowing operator to instruct and confirm subject understanding.                                                                                                                       |
| -10 dB Switch    | Reduces sound pressure level by 10 dB and provides an automatic "EVENT MARKER" on audiogram. (Does not reduce normal test time.)                                                                                |
| PULSE Switch     | Pulses the pure tone at a rate of two and one-half Hertz with a duty cycle of 50%.                                                                                                                              |
| MID-DELAY Switch | Introduces a 15 second delay for run-down of SPL and a test interruption at the end of 8000 (6000) Hz left ear test, to protect right ear from excessive initial test tone.                                     |
| AUTO-VALIDITY    | After each test tone there is a two second period when no test tone is applied to the headphones. The subject's natural response is to release the handswitch when no tone is present. Thus a spike will appear |

| <u>Name</u>                 | <u>Function</u>                                                                                                                                             |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AUTO-VALIDITY,<br>continued | on the audiogram at each change in frequency which allows the operator to quickly ascertain whether or not the subject's response is valid. (See figure 2.) |
| 115/230 Switch              | Rear panel selection of normal line voltage.                                                                                                                |
| MASTER/SLAVE<br>Switch      | Rear panel selection for normal ('MASTER') or group operation ('SLAVE'). See "Set-Up Procedure--Group".                                                     |
| REAR PANEL CONNECTORS       |                                                                                                                                                             |
| GROUP                       | Connection for group testing, i.e., two or more audiometric stations.                                                                                       |
| HANDSWITCH                  | Connects the subject handswitch with the audiometer.                                                                                                        |
| PHONES                      | Connects the subject headphones with the audiometer.                                                                                                        |
| POWER CORD                  | Connection to 115/230 VAC.                                                                                                                                  |

#### SET-UP PROCEDURE, NORMAL OPERATION

Before attempting to turn on or operate the Rudmose ARJ-4C Automatic Recording Audiometer, the operator should arrange a convenient and stable mounting surface for the instrument.

To remove the top cover of the audiometer, proceed as follows: (See figure 2.)

- a) Move the top segment of each latch out and down.
- b) Move the bottom segment of each latch out and up.
- c) Lift the cover and slide the cover to the right until the hinges are free.
- d) Insert the earphones and handswitch into the appropriate sockets on rear panel.
- e) Be sure the wall plug supplies the correct voltage (115 or 230 volts, 50-60 Hz) and that the line voltage switch is set to the corresponding position.
- f) Place MASTER/SLAVE switch to MASTER position.

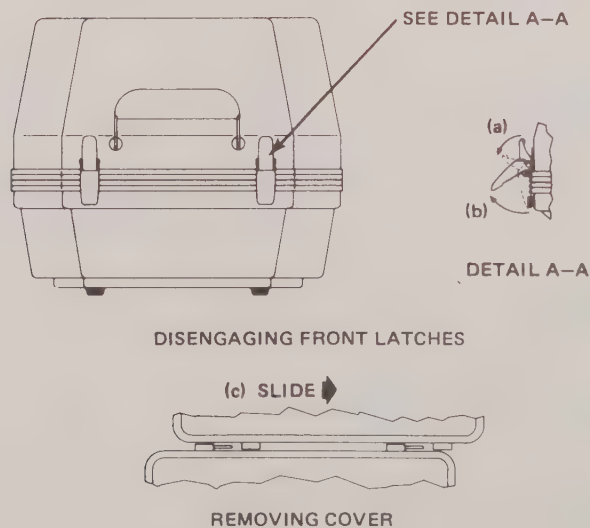


Figure 2 Release Latch and Hinge

## SET-UP PROCEDURE, GROUP OPERATION

On the rear panel is a switch labelled 'MASTER-SLAVE'. On instruments that are to be operated independently (not connected with the group interconnect cable), this switch must be placed in the 'MASTER' position.

For a 'GROUP' installation, connect the Group Interconnect Cable and place all switches, except for one audiometer, to the 'SLAVE' position, and the remaining audiometer switch to the 'MASTER' position. This audiometer is now designated as the 'MASTER' and all other audiometers as 'SLAVES' for the test and trial functions only. Functions of -10 dB, Mid-Delay and Pulse remain independent at each audiometer station.

## OPERATION PROCEDURES

To operate the ARJ-4C audiometer, proceed as follows:

- a) Place PWR ON/OFF switch to ON position.
- b) Squeeze the table release knob and move the table all the way out. (See figure 1.) For your convenience table release knob may be locked in squeeze position. (See figure 3.)
- c) Insert the audiogram card and press the card onto the table guides. (See figure 1.)
- d) Return the table to the starting position (with table pushed in).
- e) Depress TRIAL switch.
- f) Depress TEST switch.
- g) Depressing handswitch should reverse pen motion.

- h) Release TRIAL switch and observe table advance.
- i) Depress TEST switch again to STOP test.

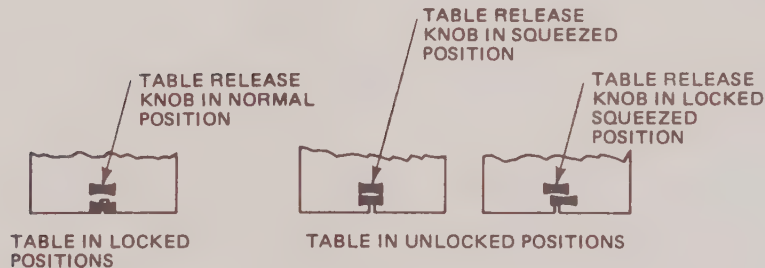


Figure 3 Table Release Knob Positions

#### INSTRUCTING THE SUBJECT

If the subject has been exposed to loud noise during the day, it is best to postpone his test until another day. If this is impossible, note on the back of his audiogram card the type of noise, circumstances, and duration of exposure, and time between exposure and audiometric test.

Each operation will learn from experience the best way to instruct his subjects. The following instructions are offered as suggestions. It is frequently desirable to describe the test to the subjects in some detail as follows:

"After I adjust the earphone, you will be given time to practice before the test begins. At first, you will hear nothing. Wait until you hear the tone or whistle to push the switch. Hold the switch down only as long as you hear a tone. Once the test is started, it will go without interruption for approximately seven minutes."

Many operators have found that the simple instruction, "PRESS AND HOLD WHEN YOU HEAR, RELEASE WHEN YOU DON'T," is adequate.

#### POSITIONING THE EARPHONE

The earphones must be positioned correctly to function properly. The following procedure is recommended to insure correct measurements:

- a) If the subject wears glasses, have them removed.
- b) Grasp an earphone in each hand and pull them far enough apart to slip over the subject's head.
- c) Place the red phone over the subject's right ear and the blue phone over his left ear.
- d) Center the phones over the ears.
- e) Be sure that no hair is under the earphone cushion.
- f) Adjust the headband to fit snugly over the top of the subject's head.

#### C\_A\_U\_T\_I\_O\_N

UNDUE MECHANICAL SHOCK MAY CHANGE THE  
CALIBRATION OF THE HEADSETS.

## ADMINISTERING THE TEST

After completing the set-up procedures, proceed as follows:

- a) Fill out an audiogram card.
- b) Pull out the table and install the audiogram card.
- c) Set the table to the starting position.
- d) Instruct the subject.
- e) Fit the earphones over the subject's ears.
- f) Depress the TEST switch.
- g) If a practice session is desired, depress the TRIAL switch.
- h) When the practice session is deemed adequate, release TRIAL switch.
- i) To check the validity of any subject's response, depress the -10 dB switch. If he is responding correctly, his hearing loss will increase by 10 dB.
- j) Remove the completed audiogram.

## INTERPRETING THE AUDIOGRAM

- a) If the sweeps are 10 dB or less, score the audiogram by drawing a line through the center of the sweeps and recording to the nearest 5 dB. (See figure 4.)
- b) If the sweeps are greater than 10 dB, average the readings for the top of the peaks and add 5 dB to obtain the threshold reading.
- c) If the sweeps in the low frequencies are 10 dB or less, and the sweeps in one or more of the high frequencies

are more than 10 dB, average the valleys of the wide sweeps to the nearest 5 dB and subtract 10 dB from that figure. Score the low frequency sweeps according to step a.

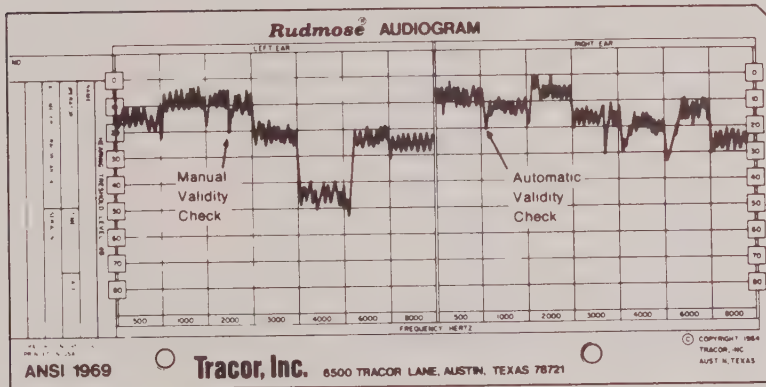


Figure 4 Audiogram Card/ARJ-4C/7

#### ROUTINE MAINTENANCE

- 1) Cartridge pen replacement. Lift cover and install new cartridge (Tracor Part No. as shown in figure 5).
- 2) Control lamp replacement. Snap cap from pushbutton using pointed tool. Remove failed bulb using lamp tool supplied by pressing down and twisting counter clockwise until bulb lifts out. Install new bulb in similar manner, pressing down and twisting clockwise, as shown in figure 6.

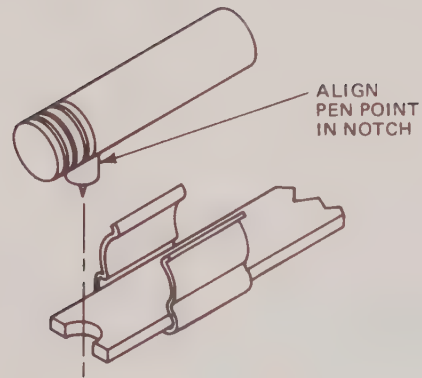


Figure 5 Replacement of Cartridge Pen

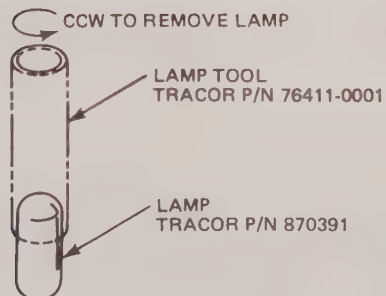


Figure 6 Replacement of Lamp

## SECTION II

### SPECIFICATIONS ARJ-4C

|                                      |                                                                                                                                                                                                                                                                                      |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| POWER:                               | 115 or 230 volts AC, 50-60 Hz at 25 watts.                                                                                                                                                                                                                                           |
| DIMENSIONS:                          | 9½ x 11 x 21 inches; weight 20 lbs. Shipping weight 30 lbs.                                                                                                                                                                                                                          |
| TEST FREQUENCIES<br>ARJ-4C/7         | Seven discrete, 500, 1000, 2000, 3000, 4000, 6000 and 8000 Hz ± 3%.                                                                                                                                                                                                                  |
| TEST FREQUENCIES<br>ARJ-4C/6         | Six discrete, 500, 1000, 2000, 3000, 4000, and 6,000 Hz ± 3%.                                                                                                                                                                                                                        |
| SIGNAL MODES:                        | Selectable; either continuous or pulsed at 2.5 Hz ± 0.5 Hz, with a rise time not less than 20 ms or greater than 100 ms, and a fall time not less than 5 ms or greater than 100 ms. Pulse duty cycle 50% ± 5% with an on to off ratio of at least 50 dB. Overshoot less than 0.1 dB. |
| ATTENUATOR:                          | Continuous wire-wound with a dynamic range of 100 dB and resolution of 0.25 dB.                                                                                                                                                                                                      |
| ATTENUATION RATE:                    | Constant at 5 dB per second.                                                                                                                                                                                                                                                         |
| HEARING THRESHOLD RANGE:             | -10 to 90 dB.                                                                                                                                                                                                                                                                        |
| TRANSDUCERS:                         | Two each TDH-39, 100 ohm earphones mounted in MX-41/AR cushions. Each transducer color identified, with red = right and blue = left.                                                                                                                                                 |
| PURITY OF TEST TONE:                 | Total harmonic distortion at least -30 dB below level of fundamental tone, typically -40 dB.                                                                                                                                                                                         |
| ACCURACY OF SOUND<br>PRESSURE LEVEL: | ± 3 dB at frequencies of 500-4000 Hz<br>± 5 dB at 6000 and 8000 Hz.                                                                                                                                                                                                                  |
| OPPOSITE EARPHONE<br>SIGNAL:         | -70 dB or greater from 'ON' earphone.                                                                                                                                                                                                                                                |

## Specifications, Continued

## TEST INTERVALS:

|                     |                                                                                                                                                                                                   |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TONE:               | 28 seconds each test frequency, each ear.                                                                                                                                                         |
| AUTO VALIDITY:      | 2 seconds off period at termination of each test tone.                                                                                                                                            |
| -10 dB              | Momentary selectable switch to lower sound pressure level to transducer by 10 dB and disables recorder drive for event marker on audiogram card.                                                  |
| MID DELAY           | Selectable, mid-test-delay of 15 seconds $\pm$ 3 seconds to override attenuator toward -10 dB HTL at end of 8000 Hz (6000 Hz) tone for left ear.                                                  |
| TRIAL               | Selectable, override to disable recorder drive.                                                                                                                                                   |
| TEST LENGTH         | Seven minutes $\pm$ 2%. 15 seconds longer when mid-delay is used.                                                                                                                                 |
| RECORDER            | Continuous writing, using a black or red nylon cord tip pen.                                                                                                                                      |
| OPERATING CONTROLS: | Test, -10 dB, Pulse, Mid-Delay, Trial and Power.                                                                                                                                                  |
| AUXILIARY CONTROLS: |                                                                                                                                                                                                   |
| GROUP CONNECTOR     | Provides control of group test functions of Start/Stop and Trial.                                                                                                                                 |
| MASTER/SLAVE:       | Rear panel switch for use in group configurations, with one unit designated as 'Master' and remaining units designated 'Slave'. For single unit operation, switch is placed in 'Master' position. |

## Specifications, Continued

## REAR PANEL CONNECTIONS

- 1) Headphones
- 2) Handswitch
- 3) Group

## CALIBRATION

Calibrated per American National Standards Institute (ANSI) S3.6-1969, unless otherwise specified.

## SECTION III

## TECHNICAL DESCRIPTION

This technical description provides a qualified service man with sufficient information for minor servicing and routine calibration of the ARJ-4C audiometer. If major problems are encountered, it is recommended that the service man contact Customer Service at Tracor Austin giving full and accurate details; such as, serial number, date of purchase, description or part and Tracor part number.

This section is divided into two parts; Part A, 'Mechanical Description' and Part B, 'Electrical Description'. The reader should refer to the drawings, parts list, illustrations and tables of this manual to aid in understanding the instrument.

## PART A. MECHANICAL DESCRIPTION

The very heart of the automatic recording audiometer is the audiogram card; the actual hard copy of an individual's hearing thresholds per frequency and ear being tested. The integrity of this audiogram can be no better than the quality of the recording mechanism and the methods used to mechanically align it. As a minimum, the audiogram card must accurately display two items, frequency of the test tone and intensity of that tone.

The audiogram card is attached to the table assembly with the aid of two locating guide-posts. These guide-posts rigidize the audiogram card and provide a repeatable method of locating the card. The motorized table assembly traverses the length of the instrument, along two table guide rods, which provides the means to represent time and frequency, recorded on the audiogram card by a nylon cord tip pen (see figures 4 and 8). The intensity of

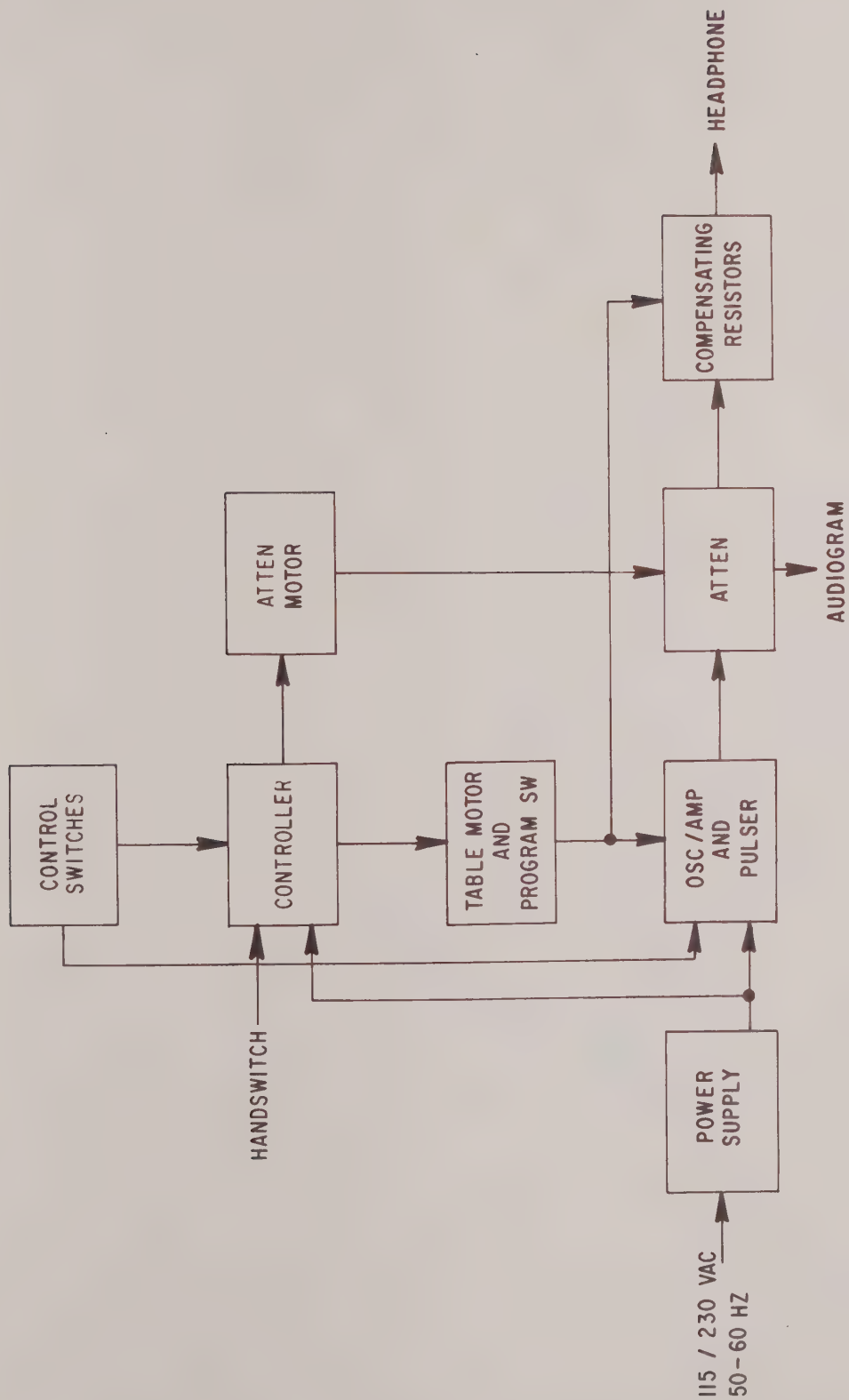


Figure 7 ARJ-4C Audiometer Block Diagram

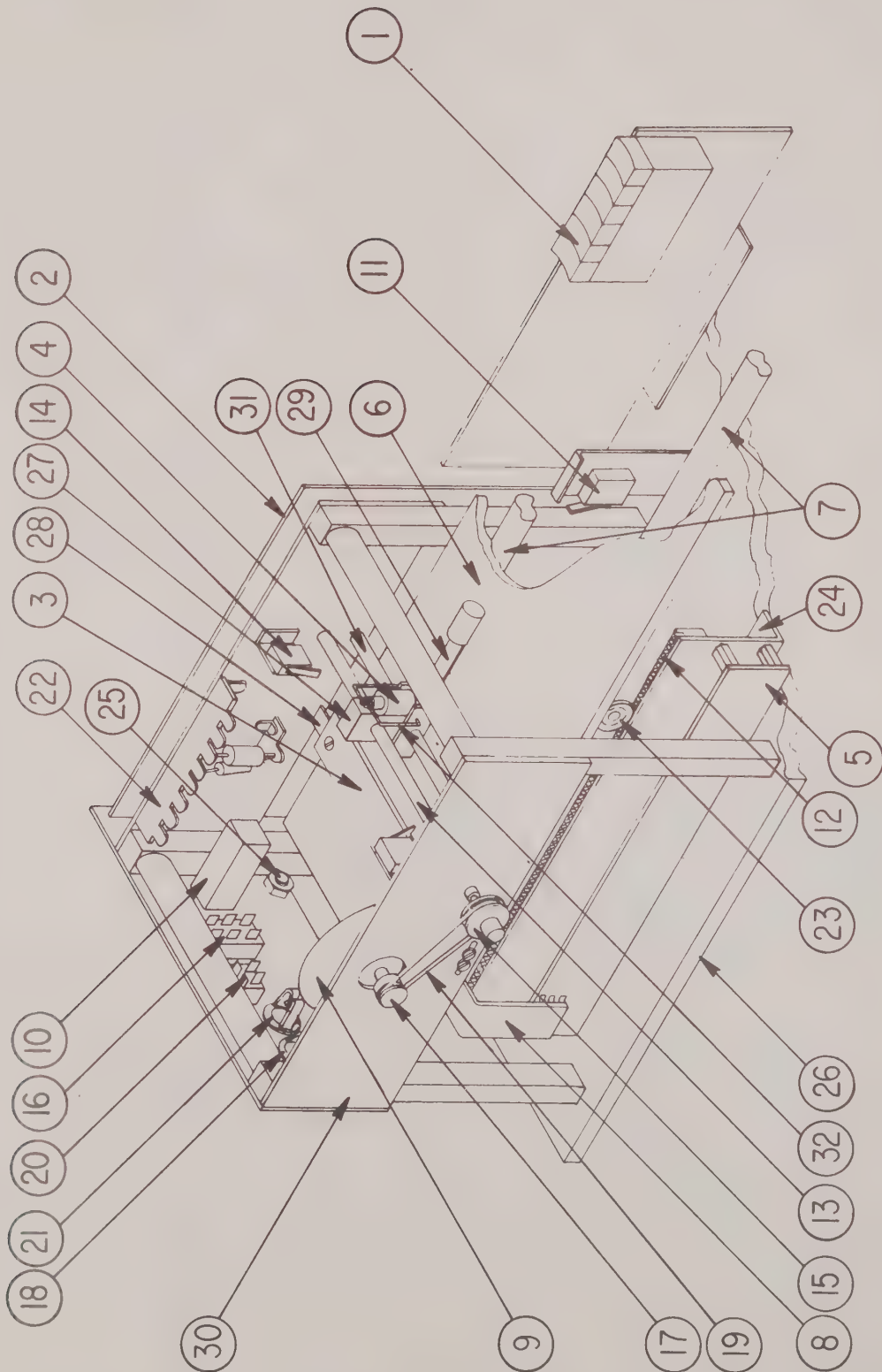


Figure 8 ARJ-4C Mechanical Assembly

## FIGURE 8 LEGEND

1. FUNCTION CONTROLLER PCB ASSEMBLY 19546-0001
2. AUDIO PCB ASSEMBLY 19475-0001
3. ATTENUATOR ASSEMBLY 751318
4. PEN ASSEMBLY WITH SOLENOID 18915-0002
5. PROGRAM SWITCH PCB 18895-0001
6. TABLE ASSEMBLY 18969-0001
7. TABLE RODS 18939-0002
8. PROGRAM SWITCH WIPER 9607
9. ATTENUATOR DRIVE MOTOR 3839-1847
10. FUSEHOLDER 76339-0879
11. TABLE LIMIT SWITCH AND MECHANICAL STOP 76366-0002
12. RACK 6852
13. ATTENUATOR LEADSCREW 18887-0001
14. ATTENUATOR MOTOR DRIVE LIMIT SWITCH (INCREASE) 76366-0002
15. LEADSCREW PULLEY 19550-0002
16. 115/230 VAC MODE SWITCH (S4) 3633-0001
17. ATTENUATOR MOTOR PULLEY 19550-0001
18. HEADPHONE OUTPUT JACK 3448-0011
19. 'O' RING BELT 3814-2138
20. GROUP INTERCONNECT JACK 3648-0006
21. HANDSWITCH JACK (J3) 3448-0011
22. TERMINAL STRIP
23. PINION GEAR 6836
24. PROGRAM SWITCH ASSEMBLY 18974-0001
25. TABLE LIMIT MECHANICAL STOP 525-0040
26. CHASSIS 19644-0001
27. LEADSCREW BLOCK 18938-0001
28. ATTENUATOR MOUNTING BRACKET 751143
29. PEN CARRIAGE 18961-0001
30. LEFT SIDE PLATE 19646-0001
31. GUIDE ROD, PEN 754095
32. BAIL, PEN 18646-0001

the test tone is recorded by lateral movement of the same pen. This lateral motion of the pen is accomplished by a separate motor assembly located within the recorder, designated as the Attenuator Drive Motor.

Located on the underside of the table assembly is a 1 rpm 60 Hz 115 VAC synchronous motor swivel mounted in a motor housing. The swivel mount provides a means of engagement or disengagement to a rack gear. A table rob push level is located at the front of the table assembly (see figure 3). This push lever provides the coupling to the table motor to disengage the motor from the rack gear. Coupling between the motor and rack gear is accomplished by a pinion gear, and rotation of the pinion gear drives the table assembly against the stationary rack gear.

The motion of the table assembly must be synchronously related to the frequency being displayed on the audiogram card and the frequency being presented to the subject. A Program switch provides actuation of the frequency desired, to the Audio PCB Assembly, by means of the Program Switch Wiper. This switch wiper is part of the table assembly, and as the table moves down the length of the table rods, the wiper makes contact with the switch pads on the Program Switch. In addition the Program Switch keys the left/right function and mid-delay enable. Synchronization of the Program switch with respect to the frequency event lines on the audiogram card is accomplished by positioning the Program switch assembly in slotted holes on the base plate chassis.

At the end of each audiometric test, the table assembly is fully extended toward the front of the recorder. A new audiogram card is placed on the table surface and the table motor push level is depressed, disengaging the table motor, and the table assembly

is pushed to the rear of the recorder assembly, where it comes in contact with the 'Start Position Table Limit Adjustment' screw. This nylon screw provides a mechanical limit for the table assembly when it is fully loaded. After the table assembly has been placed in the Start position the table motor push level is unlocked, re-engaging the table drive motor with the start command given from the Function Controller PCB assembly, the table assembly will once again travel down the length of the table rods until it reaches the Table Limit switch. Upon actuation of the Table Limit switch the 'Stop' command (end of test) is coupled to the Function Controller PCB assembly, removing the power from the table drive motor. In addition to serving as a mounting bracket for the Table Limit Switch, the bracket also serves as a mechanical stop for the table assembly, and the location of this mechanical stop may be adjusted by positioning the bracket in slotted holes on the base plate chassis. Power is also removed from the table drive motor when -10 dB or the Trial (practice) pushbuttons are depressed, or the 15 second event of mid-delay occurs.

The righthand table rod is "floated" on each end of the recorder. This floating action allows the rod to freely turn or move within the mounting hole at each end of the instrument. This is accomplished by the use of self-locking screws. The 'floated' table rod must not be locked down or tightened. The lefthand table rod, however, is rigidized.

Located on the lefthand side plate of the recorder assembly is the Attenuator Drive Motor. This bi-directional 300 rpm, 115 VAC, 60 Hz synchronous motor drives a leadscrew block via an attenuator motor pulley, an 'O' ring belt, the leadscrew pulley, and the leadscrew itself. Attached to the leadscrew block is the pen assembly with solenoid, and the attenuator wiper bar. The

relationship of the pen and attenuator wiper is one-to-one, therefore assuming the attenuator assembly is mechanically aligned, the print-out on the audiogram card will faithfully represent the actual intensity of the tone.

To accomplish the control or variation in intensity, the leadscrew block travels the length of the leadscrew, while the attenuator wiper bar makes continuity to the attenuator. On each recorder side plate is located a snap switch and bracket. Each snap switch is wired to perform the function of an attenuator motor drive limit switch. The actuation of the increase and decrease limit switches is adjusted by bending the leaf of the switch to coincide with -10 and 90 dB HTL on the audiogram card. Upon energization of either attenuator motor limit switch, power is removed from the attenuator motor. These are the only events that remove the power from the attenuator motor.

On each end of the attenuator assembly is a #4 screw which fastens the attenuator to a mounting bracket. Each bracket has slotted holes to allow lateral adjustment of the attenuator to coincide with -10 and/or 90 dB HTL on the audiogram card. The tension that the wiper bar exerts on the front of the attenuator may be adjusted by positioning the brackets in slotted holes on each side plate. Each bracket is adjusted independently for the proper amount of contact tension and insuring that the front surface of the attenuator is parallel to the wiper bar.

Directly below the leadscrew is a guide-rod for the pen carriage. This guide rod allows a pivot point for the pen carriage. In a "not test" condition (Stop or End of Test), the pen must be lifted to allow unloading and reloading of an audiogram card and to allow manual positioning of the table assembly without marking the card. This lifting action is accomplished by a solenoid

whose plunger is spring loaded. When the solenoid is not energized, the spring pushes the plunger upward, and this upward pressure is coupled to a bail which in turn lifts the pen carriage. When the solenoid is energized (Test Run) the plunger is "pulled in" bucking the spring. With the plunger pulled in, the bail loses its upward contact pressure with the plunger allowing the pen carriage to lower, or pivot, on the guide rod until the pen comes in contact with the card. Only the weight of the pen carriage and the pen come in contact with the card surface. Two teflon inserts provide the bearing surface for the pen carriage to pivot on.

Mounted on the inside of the right side plate of the recorder is a convenience terminal strip. This terminal strip provides a tie point and distribution for the 115 VAC input, the attenuator drive motor and the pen solenoid.

## PART B. ELECTRICAL DESCRIPTION

The ARJ-4C is electrically divided into three subsystems:

- 1) The Audio PCB Assembly, 2) The Function Controller PCB Assembly, and 3) The Interconnecting Wiring Harness.

### Audio PCB Assembly (see figure 9) \*

#### a) Oscillator

The oscillator is composed of four active components: U1, U2, Q1 and Q2. U1, an operational amplifier (op amp) performs the basic oscillator function, being wired as a Wein bridge type. Pin 2 the inverting input of U1 provides the summing point for the two legs of the Wein bridge. The basic parts of the parallel leg are composed of C1, C2 and R24 which is connected to the output of U1 at pin 6. The basic constituents of the series leg are C7, R18 and R34. With the impedance being equal in each leg of the Wein

\* NOTE: 6 & 7 frequency ARJ-4Cs use the same audio PCB assembly.

bridge the 'rest' frequency of the oscillator is 500 Hz. C2, the 1000 pf variable capacitor provides an adjustment range of  $\pm 5\%$ , which is more than adequate to compensate for the tolerances of C7 and C1, which is 2%, and the tolerances of R24, R18 and R34, which is 1%. The ratio of R18 and R34 to R24 is approximately 5, and the ratio of C1 and C2 to C7 is also five. This asymmetrical arrangement provides lower total harmonic distortion. Change in operating frequency is accomplished by placing fixed 1% resistors in parallel with the basic Wein bridge network. For example, with K7 energized R64 and R65 are placed in parallel with R18 and R24, respectively. R64 and R65 lower the RC Product of each leg thereby raising the frequency to 8000 Hz. For a frequency of 1000 Hz, K2 would be energized, placing the sum of R19-R23 and R65 in parallel with R24 and the same would hold true for the series leg; R13-R17 and R64 placed in parallel with R18. The sum of R19-R23 and R65 is  $\approx$  to the value of R24, 71.5K ohms. Each time the frequency of the oscillator is to be double the net resistance of each leg of the Wein bridge would be halved. K2 through K7 is a four pole single-throw normally open reed-relay (form 4A). Two of the four poles are used to switch in the respective components in each leg of the Wein bridge, and the remaining two poles switch in the output level adjustment controls for both Left and Right Earphones. Since the oscillator 'rest' frequency is 500 Hz, K1 need only to be a Form 2A which switches in the output level adjustment controls R1 and R7.

The sine-wave output at pin 6 of U1 varies from 2.0 to 2.5 volts peak-to-peak in amplitude depending on tolerances of components. The ideal voltage gain for U1 to achieve lowest total harmonic distortion is approximately 3. The voltage gain is established by the ratio of R25, 25.5K ohms, to the sum of R26 and the parallel combination of R27 and the resistance across the drain to source terminals of Q1.

The sine wave output at pin 6 of U1 is referenced to a quiescent DC voltage of +12 volts. This is due to the fact that the DC supply voltage for Audio PCB Assembly is +24 volts. The signal at pin 6 of U1 is routed to two main locations: 1) the power amplifier through R36 and V1, and 2) U2, through R29. U2, also an op amp, is used as a gain stage and also provides isolation between the output of U1 and the input of Q2. The voltage gain of U2 is approximately 5, as determined by the ratio of R29, 10K ohms, and R30, 47K ohms. Therefore the sine wave amplitude at the output of U2, pin 6 is approximately 10 to 12.5 volts peak-to-peak. This amplified signal is applied to the base of Q2 where it is summed with a sine wave signal extracted from across R34, the sample resistor which is part of the series leg of the Wein bridge. The sine wave across R34 is much smaller in amplitude than the sine wave from the output of Q2, however, there is a 90° phase difference between the two.

These two signals are applied to the base of Q2 whose emitter is referenced to a DC voltage of +10 volts. Since Q2 is a PNP transistor, only the negative portions of the signals summed at the base will cause current flow through the collector. As the current flows through Q2 a positive DC voltage is developed across R33 and filtered by C6. The DC voltage, approximately +9 volts, is applied to the gate of Q1 and acts as an AGC signal for U1. As the amplitude tends to vary at pin 6 of U1, the DC voltage at the gate of Q1 will also vary, causing the resistance across the source to drain terminals to vary. Since the resistance of Q1 makes up part of the total resistance in ratio to R25, which ultimately establishes the output amplitude, it can be seen that 'temporary' amplitude variations are eliminated because the feedback loop compares the output of the oscillator to a fixed reference point, that being the +10V supply.

In summary, U1 provides a low distortion sine wave whose amplitude is stabilized by a feedback loop comprised of U2, Q2 and Q1.

b) Pulser

The pulse network is comprised of three active components, U4, Q6 and V1. The purpose of the pulser is to provide a 2.5 Hz control signal with fixed rise and fall time, to 'gate-on' the signal to the power amplifier. If selected by the user not to use the pulse tone, the pulser network also provides a steady-state or continuously on signal.

U4 is a quad (4) 2 input NAND gate of which only three gates are used. The first two gates (from left to right) are wired as an astable multivibrator whose 2.5 Hz clock rate is determined by the RC product of R47 and C12. To 'enable' the multivibrator, a +24 volt DC signal is switched in on pin 'S' of P1 and applied to the voltage divider network R48 and R49. Conversely, removal of the +24 volts at pin 'S' of P1 disables the multivibrator, at which time the output of U4 pin 4 'locks up' low, i.e., a steady state voltage of approximately 0 volts.

The third gate is wired as an inverter simply to transform the logic 0 (low) to a logic 1 (high). This high state voltage is approximately +12 VDC because the supply voltage to U4 is +12 VDC. The product of R45 and C11 transforms the otherwise abrupt transitions of the 2.5 Hz square wave to a slower and fixed rise and fall time of approximately 50 ms.

Q6 is wired as an emitter follower to supply the 30 ma needed to turn on V1's Light Emitting Diode (LED). Within the same package, V1 contains a photosensitive resistive element. Light emitted from the LED changes the resistance of the element

from approximately 10 MEG ohm to approximately 500 ohms. Since the resistive element of V1 is in series to the input of the power amplifier, the tone from the oscillator can now be pulsed off and on with controlled rise and fall times.

### c) Power Amplifier

The power amplifier is composed of five active components: U3, Q3, CR13, Q4 and Q5. The voltage gain of the power amplifier is approximately 6 and is determined by the ratio of R42, 6.49K ohms, to the sum of R36 and V1, 470 and approximately 500 ohms, respectively. Therefore the sine wave output at the plus terminal of C10 is a minimum of 10 volts peak-to-peak, regardless of oscillator frequency selected. The load for the power amplifier is essentially the 100 ohm attenuator assembly. U3, providing the voltage gain, drives Q4 and Q5 (via Q3) providing the necessary current gain to drive the 100 ohm load. The DC voltage, at quiescence, is +12 volts. On the positive half cycle of the sine wave, current flows through the attenuator, C10, Q4 and R39, to the +24 volt supply. During the negative half cycle, Q4 is turned off and Q5 is turned on via Q3, an inverter. As Q5 begins to turn on, it causes C10 to discharge through the attenuator, thus producing the negative half cycle. Diode CR13 provides a fixed reference of 0.6 VDC. This 0.6 VDC insures that both Q4 and Q5 are on at the same time during the period of time when the sine wave is at zero potential. Thus the cross over distortion produced by Q4 and Q5 is eliminated. Resistor R43 provides the reduction in gain of 10 dB when the -10 dB switch is depressed. When continuity is achieved across pins R and T of P1, R43 is placed in parallel with the main feedback resistor R42, increasing the negative feedback.

#### d) SPL Adjustment Controls and Left/Right Relay

The attenuated tone from the output of the attenuator is returned to the PCB on pin V of P1, where it is connected to two commons supplying R1 through R12, R66 and R67. Assuming K2 is energized, R2 and R8 are placed in series with the input on pin V of P1. Since only one earphone is used at a time, K8, the Left/Right relay, selects only one of the two variable resistors R2 or R8. K8 is a two pole, single throw relay (form 1A1B). As in figure 9, the diagram schematic, K8 is drawn in its un-energized position, in that continuity is accomplished to Left earphone adjustments only. Conversely when K8 is energized the Right earphone adjustments are selected. The output of K8 at pins U and Y of P1 is directly connected to the earphones. Each Level adjustment provides approximately 25 dB of control.

#### e) Power Supply

The 115 or 230 VAC line power is connected to a transformer (T1) mounted in the chassis. The secondary winding provides approximately 24 VAC to the audio PCB assembly at pins H and L of P1. The 24 VAC signal is rectified by CR9 through CR12, which are wired as a full-wave bridge. The 120 Hz pulsating DC voltage is filtered and smoothed by C16, a 1000 mfd capacitor. The resultant DC voltage is approximately 32 VDC with a saw-tooth AC component of approximately 1.5 volts peak-to-peak. This un-regulated DC voltage is applied to the input of U5, a 24 volt regulator. The output of U5 provides a well regulated +24 volt DC signal, which is both short circuit proof and thermally protected.

#### FUNCTION CONTROLLER PCB ASSEMBLY (See figure 10)

The Function Controller PCB Assembly provides the following functions: (a) Attenuator Motor Control, (b) Table Motor

Control, (c) Pen Solenoid Control, (d) Start/Stop Control, (e) Mid-Delay, (f) Power Supply, (g) Control Switches, and (h) Slow Response Option (if included).

a) Attenuator Motor Control Circuit

The Attenuator Motor Control circuit consists of eight active components or sub-components. They are: U3C, U4D, Q3, Q4, V1, V2, Q7 and Q8. The output of U3C, a three input NOR gate, at pin 8 may be at one of two states or levels: Logic 0,  $\leq 0.8$  VDC or Logic 1,  $\geq 2.5$  VDC. A logic 0 output at pin 8 of U3C equates to the attenuator motor 'running down' toward 0 dB HTL on the audiogram or simply 'decreasing'. Conversely, a logic 1 equates to the attenuator motor 'running up' toward +90 dB HTL or 'increasing'. If the command is given to stop the test (end of test), the output of U3C would be logic 0 coupled to the base of Q3 and the input to U4D at pin 11. The logic 0 at the base of Q3 turns it off, preventing current flow through the Light Emitting Diode within V2. At the same time, the logic 0 at pin 11 of U4D causes the output of U4D to go high (logic 1) which is coupled to the base of Q4, turning it on, allowing current to flow through the LED within V1. V1 and V2 provide electrical isolation between the DC control circuits and the AC voltages present at Q7 and Q8. With V1 on, the resistance across the cell terminals goes from approximately 10 MEG ohms to a few hundred ohms, approximately 500, thus allowing the 115 volt currents to be high enough to trigger or gate on Q7. Q7 and Q8 are triacs which work as bilateral switches for the AC voltage. On each half cycle of the 60 Hz, 115 volt signal, one half of Q7 is gated on via V1. Once Q7 has been gated on for that half cycle, continuity is achieved across pins 1 and 2.

The DC levels at the bases of Q3 and Q4 are 180 degrees out of phase because U4D is an inverter. Therefore, only one triac can conduct at a time. The attenuator motor limit switches are wired in directly to the bases of Q3 and Q4 from J1 pins 17 and 18. Upon actuation of either switch, a ground is applied to the base of the respective transistor, turning the device off, thus stopping the attenuator motor.

#### b) Table Motor Control Circuit

The Table Motor Control circuit consists of four active components or sub-components. They are: U3A, Q5, V3 and Q9. In like manner to the Attenuator Motor Control circuit the output of U3A at pin 12 may be in one of two states: Logic 1 for test run, table motor running, or a Logic 0 for test stop, table motor not running. Part of S2, the -10 dB switch is wired in to the base of Q5. Each time S2 is depressed a ground is applied to the base of Q5, turning the table motor off. The table limit switch is connected to the start/stop circuit rather than directly to the table motor circuit and is ultimately NOR'd with the Trial push-button S5. Actuation of S5 also causes the table motor to stop.

#### c) Pen Solenoid Control

The Pen Solenoid Control circuit consists of two active components, Q1 and Q2. The output at the collector of Q1 connects to J1 pin 20 which connects to one side of the solenoid. The opposite side of the solenoid connects to its voltage supply at the center tap of the transformer T1. This operating voltage is approximately 16 VDC unregulated. To activate the solenoid a ground is applied by Q1 turning on. Q1 is turned by Q2 turning off, and Q2 is directly controlled by the output of the Start/Stop circuit.

#### d) Start/Stop Control

The Start/Stop Control circuit consists of one active device, U2, and two peripheral devices, Q6 and S1. S1, the TEST pushbutton, is momentary, therefore the lamp within the switch must be turned remotely via Q6. When Q6 turns on the collector 'pulls down' applying a ground to the lamp DS1, turning it on.

DS1 is a direct indicator of instrument status of either START (run) or STOP (end of test). Therefore, a logic 1 at pin 9 of U2 indicates 'start' and a logic 0 indicates 'stop'.

U2 is a Dual 'D' flip/flop whose first 'D' flip/flop is wired in a set-reset (RS) configuration and the second half is wired as a toggle (T) flip/flop. The output of the RS flip/flop is connected to the clock input of the T flip/flop. Each time S1 is depressed, and for the period of time it is depressed, the output of the RS flip/flop goes low and clocks the input to the T flip/flop. The output of the T flip/flop changes states and holds at that state each time the TEST pushbutton, S1, is depressed.

Two outputs are available from the T flip/flop. The Q output is at pin 9 of U2 and the  $\bar{Q}$  output is at pin 8. As indicated earlier, the test lamp is a direct indication of test status and is connected via Q6 to pin 9 of U2, the Q output. The  $\bar{Q}$  output at pin 8 is directly out of phase with the Q output, therefore a logic 1 at pin 8 indicates a stop condition and conversely a logic 0 indicates a start. The start/stop command is applied to two separate three-input NOR gates, U3-C and U3-B. U3-C performs the combining function of the start/stop, handswitch, and mid-delay control outputs.

e) Mid-Delay

The Mid-Delay circuit consists of one active component, U1, a Universal Timer wired as a one-shot. The duration of the one-shot event is 15 seconds and is determined by the RC product of R6 and C4. Mid-Delay switch S4 connects the enable input of U1 to the enable pad on the program switch via R2 and R3 which divides the +24 volts from the program switch to +5 volts. R1 and R4 provide the same voltage from the seventh frequency pad on the program switch to the trigger input of U1. The one-shot firing sequence of U1 is as follows: (1) pin 4 is low (approximately 0 volts), pin 2 is high (approximately 5 volts), (2) pin 4 goes high, pin 2 stays high, (3) pin 4 stays high, pin 2 is triggered low (pulsed) through C3, (4) pin 4 high, pin 2 high, (5) pin 4 low, pin 2 high. Step 3 of the above fires the one-shot. Pin 4 of U1, the enable, must be high and stay high for the duration of the one-shot event. The output of U1 at pin 3 goes high (approximately +5 volts) during the one-shot event and is connected to U3C for attenuator motor decrease and to U3B for table motor stop.

f) Handswitch Control

The handswitch connects to pin 13 of U4E through J1-15. U4E provides an inversion of signal level plus the added benefit of a buffer. The DC level at pin 13 is normally high which provides a low at the output pin 12. When the handswitch is depressed a ground is applied to pin 13 of U4 causing pin 12 to go high (approximately +2.7 volts, or greater). The output of U4E is applied to U3C, where it is combined with the start/stop and mid-delay outputs.

The NORing function of U3C is as follows: (a) output of U1 mid-delay at a logic 0, (b) output of U4E handswitch at a

logic 0, (c) output of U2 start/stop at a logic 0. All three inputs must be at a logic 0 in order to have a logic 1 at the output of U3C. As mentioned earlier in this section, the output of U3C is a logic 1 for an attenuator motor increase drive via Q3.

U3A and U3B perform the same NORing function as U3C except for the table motor drive command. U3B NOR's the mid-delay, start/stop, and trial functions. The output of U3B is applied to U4C an inverter whose output at pin 8 is coupled to U3A. U3A performs as an inverter when the Slow Response Option (SRO) is not used. When the SRO is incorporated U3A NOR's the table drive command with the output of the SRO.

#### g) Slow Response Option

The Slow Response Option (SRO) is a special function that automatically increases the test time only for subjects responding slowly. The result is increased number of hearing threshold level (HTL) crossings, without affecting either attenuation rate, HTL excursion, or test time during normal responses. Most subjects respond well enough, after brief handswitch practice, to produce 6 to 10 or more HTL crossings during each test interval. A few subjects have difficulty due to tinnitus, or poor concentration, or confusion such that extra test time is needed to produce a sufficient number of HTL crossings for a valid audiogram. The SRO accomplishes this function by timing responses and stopping the audiogram travel whenever three seconds elapse between responses, then resuming the audiogram travel at the next response, or three seconds later, if no response has occurred. The three second response time corresponds to 15 dB HTL excursion (attenuation rate stays constant at 5 dB/second). Normal response will be typically less than 10 dB HTL. Thus, most subjects will

complete their audiogram without any SRO action, and a slow subject will take longer, but rarely more than an extra minute. There are no differences in audiogram interpretation because HTL excursions are not affected.

Each Function Controller PCB Assembly has space allocated for installation of the SRO. The SRO consists of the following active components: U5, Q10, CR1, and CR2. U5, in conjunction with Q10, is wired as a missing pulse detector. CR1 and CR2 allow positive going pulses to be fed to the base of Q10 each time the handswitch is depressed or released. As long as these pulses are presented to the base of Q10 within three second intervals, the output of U5 pin 3 remains at a logic 1. Each positive pulse turns Q10 on momentarily discharging C14, a 10  $\mu$ fd capacitor. If three seconds pass after a handswitch pulse, C14 reaches full charge causing the timer to change states to a logic 0. The output will remain at a logic 0 for three seconds or until the handswitch is actuated, whichever occurs first. At the end of six seconds from the last handswitch event the output of U5 will return to a logic 1 for three seconds, and recycle until the handswitch is actuated.

#### INTERCONNECT CHASSIS WIRING

(See figure 12 for 7 frequency & figure 13 for 6 frequency.)

The ARJ-4C contains one main harness assembly which interconnects the two PCB assemblies, program switch, attenuator and table drive motors, internal controls and input and output connections.

a) Transformer T1 provides the step down from 115 or 230 VAC to 24 VAC. The primary consists of two separate windings each rated for 115 VAC. S4 is wired in the primary of T1 to select either 115 or 230 VAC power line voltage. S4 is located

on the rear panel and may be operated by use of a medium size flat blade screwdriver to slide the wiper from one operating voltage to the other. Motors B2 and B3 operate off of 115 VAC and are therefore connected to the primary center tap of T1. In the normal 115 VAC operation pins 3 and 4 of T1 are connected together via S4 and constitute the low side of the 115 VAC line. In 230 VAC operation S4 is placed in the 230 volt position which connects pins 3 and 2 of T1 together placing the two primary windings in series. The 230 VAC line voltage is then applied across pins 1 and 4 of T1 so that 115 VAC is applied to each primary winding and to B2 and B3.

b) B2 and B3 each have motor limit switches. The table motor, B2, uses S5, the table limit switch. Actuation of S5 sends a logic 0 to the Function Controller PCB assembly (pin 13 of P2) which ultimately removes the 115 VAC line voltage from B2.

B3 the bi-directional attenuator motor has two limit switches, S2 and S3. S3 corresponds to +90 dB HTL on the audio-gram card and S2 corresponds to -10 dB HTL. Actuation of either switch applies a logic 0 to the Function Controller PCB assembly which removes power from the respective winding of B3. Across both windings of B3 is a RC network consisting of R1 and C2. C2 provides the necessary phase lag to operate the synchronous motor. R1 limits peak current transients generated during reversal of the motor.

S2, the lower limit switch (-10 dB HTL), also provides the common ground to relays K1-K7 on the audio PCB assembly. Actuation of S2 removes this ground, disabling the oscillator and preventing tone feedthru at -10 dB HTL.

c) L1 the pen solenoid is connected to the center tap of the secondary winding of T1. L1 is energized by application of a ground at pin 2 via the Function Controller PCB assembly. Diode CR1 reduces the voltage transient generated when the ground is removed from pin 2 of L1.

d) The audio output is supplied from the headphone jack, J1, a three-wire phone jack, which is isolated from the rear panel by a fiber shoulder washer. The common or ground at pin 3 of J1 originates from the audio PCB assembly at J5 pins J and K. This signal ground remains 'floated' from its point of origin. The audio output from pin N of J5 is applied to A1, the attenuator assembly. The wiper of A1 is mechanically driven by B3 the attenuator motor. The attenuated signal returns to the audio PCB assembly on pin V of J5 where it is adjusted for proper earphone calibration. After this signal is level calibrated, it is selected as being either left or right earphone. The left and right signals, pins U and Y, respectively, is then applied to J1.

e) Program switch S1 is constructed of PCB material with contacts etched on its surface. Pin 17 of S1 is the wiper which is a Beryllium tab finger attached to the table assembly. The wiper makes contact with a common which spans the entire length of the switch. The common is connected to the +24 volt DC power supply. Normal run motion of the table places the wiper at pin 1 of S1 (500 Hz, left ear) and traverses the length of the switch to pin 14 (8000 Hz, right ear).

f) S6, the MASTER/SLAVE switch, is located on the rear panel of the ARJ-4C. In the normal operation mode (non-group), S6 provides a ground to the START/STOP test switch (S1) on the

function controller PCB assembly. During group operation S6 is placed in the slave position, removing the ground control from the test switch. The ground control for START/STOP is derived from one designated master audiometer whose MASTER/SLAVE switch is placed in the master position.

# SECTION IV

## TROUBLESHOOTING GUIDE

### PART A - AUDIO PCB RELATED PROBLEMS

| <u>Symptom</u>                                       | <u>Probable Cause</u>                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No audio output, all other functions normal.         | <p>Earphone cord</p> <p>Earphone plug improperly connected at J1</p> <p>Wiper at A1 attenuator not making contact</p> <p>S1 program switch wiper not making contact</p> <p>Power amp inoperative--check for oscillator output at U1 pin 6.</p> <p>Check V1 for +1.8 volts DC at anode in non-pulse mode.</p> <p>Check U3, Q3, Q4, and Q5 in power amp.</p> |
| No audio output in right earphone--left earphone OK. | <p>Earphone cord</p> <p>Earphone plug improperly connected at J1.</p> <p>Wiper at S1 not making proper contact.</p> <p>K8 left/right relay.</p>                                                                                                                                                                                                            |
| No audio output in left earphone, right earphone OK. | <p>Earphone cord</p> <p>Earphone plug improperly connected at J1.</p> <p>K8 left/right relay.</p>                                                                                                                                                                                                                                                          |
| No oscillator output at pin 6 of U1.                 | <p>Check for +10 VDC at emitter of Q2.</p> <p>Check for +9 VDC at collector of Q2.</p>                                                                                                                                                                                                                                                                     |

| <u>Symptom</u>                                                                   | <u>Probable Cause</u>                                                                          |
|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| No oscillator output at pin 6 of U1.<br>(continued)                              | Check for steady state voltage at pin 6 of Q1 and Q2 of +12 VDC.<br>Check U1, U2 and Q1.       |
| No +1.8 volts DC at anode of V1 (during non-pulse mode)                          | Check for +12 VDC at base of Q6.<br>Check U4.                                                  |
| No pulse tone, all other functions normal.                                       | Check for +10 volts at pin 1 of U4 with pulse switch depressed.<br>Check U4.                   |
| Pulse rate improper or irregular.                                                | Check U4.<br>Check C12 and/or replace.<br>Reselect R47.                                        |
| One frequency not present in both ears.                                          | Check respective relay in oscillator circuit. (Ex: K1-500 Hz, K2-1000 Hz, etc.)                |
| Audio output of power amp clipping and output of U1-pin 6 in excess of 2.5 V p-p | Check emitter of Q2 for +10 VDC.<br>Check collector Q2 for +9 VDC.<br>Check Q1 and/or replace. |

#### PART B - FUNCTION CONTROLLER PCB RELATED PROBLEMS

|                                                  |                                                                                                                                                                                                         |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Table drive inoperative, all other functions OK. | Trial switch depressed (S5).<br>Check anode of V3 for +2.0 VDC.<br>Check pin 12 of U3A for a logic 1.<br>Check pins 1,2, and 13 of U3A for a logic 0.<br>Check pin 6 of U3B for a logic 1.<br>Check Q9. |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| <u>Symptom</u>                                                        | <u>Probable Cause</u>                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Attenuator motor runs only in one direction, all other functions OK.  | <p>Handswitch not connected properly.</p> <p>Check output of U3C pin 8--logic 1 for attenuator run up, logic 0 for attenuator run down.</p> <p>Check output of U4D pin 10 for inversion of logic level present at pin 8 of U3C.</p> <p>Check collector voltages at Q3 and Q4, +0.2 VDC transistor on-- +2.0 VDC transistor off.</p> <p>Check Q8 and Q7.</p> |
| Attenuator motor "shudders" in one direction, other direction normal. | <p>Check Q8 and Q7.</p>                                                                                                                                                                                                                                                                                                                                     |
| Attenuator motor does not run, all other functions OK.                | <p>Check for +24 volts DC at R16.</p> <p>Check collector voltages at Q3 and Q4, +0.2 VDC transistor on-- +2.0 VDC transistor off.</p> <p>Check Q8 and Q7.</p>                                                                                                                                                                                               |
| Pen does not lower, all other functions OK.                           | <p>Check collector voltage at Q1-- 0.2 VDC transistor on, pen solenoid energized-- +15 VDC transistor off, pen solenoid de-energized.</p> <p>Check collector voltage at Q2, +0.2 VDC Q2 on Q1 off.-- +0.6 VDC Q2 off Q1 on.</p> <p>Check base voltage at Q2. +0.6 VDC Q2 on, 0 VDC Q2 off.</p> <p>Check mechanical freedom.</p>                             |
| Mid-delay inoperative, all other functions OK.                        | <p>Check wiper contact on S1 program switch.</p>                                                                                                                                                                                                                                                                                                            |

| <u>Symptom</u>                                                                    | <u>Probable Cause</u>                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mid-delay inoperative,<br>all other functions OK.<br>(continued)                  | <p>Check S4 mid-delay switch for continuity.</p> <p>Check enabling sequence for +5 VDC at junction of R2 and R3 and +5 VDC at junction of R1 and R4.</p> <p>Check enabling sequence for +5 VDC remaining at junction of R2 and R3 and 0 volts at junction of R1 and R4.</p> <p>Check U1.</p> |
| Mid-delay timing erratic.                                                         | <p>Check wiper alignment on S1, program switch.</p> <p>Check C4 +10 <math>\mu</math>fd capacitor.</p>                                                                                                                                                                                        |
| Mid-delay interval<br>too long or short.                                          | <p>Check C4 +10 <math>\mu</math>fd capacitor.</p> <p>Re-select R6 for one-shot interval of 15 seconds.</p>                                                                                                                                                                                   |
| No start/stop control<br>via S1 TEST switch--<br>green light will not<br>come on. | <p>Check master/slave switch for proper position.</p> <p>Check table limit switch S5--<br/>should be unenergized.</p> <p>Check for +5.0 VDC at output of U6.</p> <p>Check S1 test switch for continuity.</p> <p>Check U2.</p>                                                                |
| TEST switch light for<br>S1 is not illuminating,<br>all other functions OK.       | <p>Check bulb, DS1.</p> <p>Check Q6 collector for +0.2 VDC<br/>lamp on--+15 VDC lamp off.</p>                                                                                                                                                                                                |

## SECTION V

## PREFERRED TEST PROCEDURE AND MECHANICAL ALIGNMENT

## PART A - ELECTRICAL

Suggested Test Equipment

1. High input impedance volt-ohm-meter: Minimum 20K ohm per volt.
2. Sound Level Meter with earphone coupler: Octave or 1/3 octave filter not mandatory but may be useful for calibration of narrow band noise and checks for distortion using 1/3 octave filter. Coupler need not be type 9A, but should be traceable to a NBS coupler.
3. Oscilloscope: High impedance probe and 1:1 probe, Vert Freq response minimum 1 MHz; Vert Sensitivity 1 mv per cm; single trace; INT and EXT trigger modes.
4. 100 Ohm dummy load.
5. Distortion Meter/Wave Analyzer: Range 125 Hz to 24 kHz. HP Model 302A or HP Model 331A, or equivalent.
6. Resistance decade box.
7. Frequency counter (optional)
8. RA-310 Audiometer Calibrator

Procedure

1. Connect power cord, headphones and handswitch.
2. Insure audio PCB and function controller PCB are installed correctly.
3. Place 110/230 switch to 110 position.
4. Place all control panel switches to up positions.

5. Install one (1) audiogram card on table assembly.
6. Place cartridge pen in holder.
7. Depress S6, power switch. Red light will turn on and all other lights will be off.
8. Attenuator motor will be in run-down position. Table motor will not run and pen will be in "up" position.
9. Connect scope probe to plus (+) terminal of U5 on audio PCB assembly and measure 24 VDC  $\pm$  2.0 VDC.
10. Place scope to "AC" and measure AC ripple component on 24 VDC line. Ripple will not be greater than 50 mv peak-to-peak.
11. Place scope probe on negative (-) terminal of C10 on audio PCB assembly.
12. Place table to 8000 Hz (6000 Hz for ARJ-4C/6).
13. Adjust C2 on audio PCB assembly for 8000 Hz  $\pm$  40 Hz ( $\frac{1}{2}$  of 1%).
14. Measure and record all frequencies. Tolerance is  $\pm$  3%. (Note: C3 may require a slight readjustment to place all frequencies in tolerance.)
15. Place table to 500 Hz. Measure and record total harmonic distortion. Total distortion will be at least -35 dB.
16. Repeat step 15 for all frequencies.
17. Depress S3, - Pulse.
18. Measure pulse rate. Pulse rate will be 2.5 Hz  $\pm$  0.5 Hz.
19. Measure and record rise and fall time of audio pulse. Rise time will not be less than 20 ms nor greater than 100 ms. Fall time will not be less than 5 ms nor greater than 100 ms.
20. Depress S3, - Pulse to Off position.

21. Depress S1, - Test  
Check the following functions:
  - a) Test light on.
  - b) Table motor running.
  - c) Attenuator motor running up (toward +100 dB HTL).
  - d) Pen lowered.
22. Depress handswitch and direction of attenuator will reverse, i.e., run down. Release handswitch.
23. Depress S5 Trial, and observe table motor has stopped. Release S5.
24. Pull table out slowly and observe. Pen does not lift until table limit switch is energized (S5).  
Check the following when table limit switch is energized:
  - a) Test light goes out.
  - b) Pen lifts.
  - c) Table motor stops.
  - d) Attenuator motor runs down (toward 0 dB HTL).
25. Place table to full in position.
26. Depress S1 - Test.
27. Depress S1 - Test again and observe same functions as in step 24 A through D.
28. Depress S1 - Test.
29. If required, connect resistance decade box to function controller PCB assembly at R6, Depress S4 - Mid-delay. Determine amount of resistance needed for 15 seconds  $\pm$  2 seconds.
30. Measure the time of mid-delay. Should be 15 seconds  $\pm$  2 seconds. Observe mid-delay functions:

- a) Attenuator motor runs down (toward 0 dB HTL).
  - b) Table motor stops.
31. Release S4 - mid-delay.
  32. Depress S2 and observe table motor stops.
  33. Place table to full in position and release. Measure time from start to end of test. Should be 7 minutes  $\pm$  30 seconds.
  34. Connect sound level meter with 100 ohm dummy load into earphone jack.
  35. Using a piece of tape or clip lead, energize S3.
  36. Measure and record output level at 10 dB increments. Maximum allowable error is  $\pm$  1 dB for any 10 dB step and a total arithmetical error of  $\pm$  3 dB.
  37. Confirm K1-K7 are disabled when S2 is energized.
  38. Using sound level meter. Calibrate sound pressure levels at 70 dB HTL per Table 1. Tolerance is  $\pm$  3 dB at all frequencies except 4000 Hz which is  $\pm$  4 dB, and 6000 and 8000 which is  $\pm$  5 dB.

(For units containing the Slow Response Option (SRO)--  
Tracor Part Number 19400-0001--perform the following.)

1. Connect resistance decade box at R24 on function controller PCB assembly.
2. Depress S1 - Test (to on position).
3. Select amount of resistance with resistance decade box for a table run time of 3 seconds  $\pm$  0.5 seconds.
4. Insure that table will not stop when handswitch is pushed within a 3 second interval.
5. Test complete.

## ARJ-4C RUDMOSE AUDIOMETER

SERIAL NO: 0968

DATE: 10-13-75

19470

| TEST<br>FREQ<br>HZ | MEASURED<br>FREQ<br>± 3% TOL | REQD<br>SPL<br>DB | MEASURED SPL DB |       | DB<br>TOL | TOTAL<br>HARMONIC<br>DISTORTION | OPPOSITE<br>EAR SIGNAL DB |     |
|--------------------|------------------------------|-------------------|-----------------|-------|-----------|---------------------------------|---------------------------|-----|
|                    |                              |                   | LEFT            | RIGHT |           |                                 | L                         | R   |
| 500                | 506                          | 81.5              | 81.6            | 81.4  | 3         | -44 DB                          | -91                       | -91 |
| 1K                 | 1007                         | 77.0              | 77.0            | 77.2  | 3         | -44 DB                          | -88                       | -87 |
| 2K                 | 2009                         | 79.0              | 79.0            | 79.0  | 3         | -44 DB                          | -86                       | -86 |
| 3K                 | 2996                         | 80.0              | 80.1            | 79.8  | 3         | -45 DB                          | -84                       | -85 |
| 4K                 | 4012                         | 79.5              | 79.6            | 79.5  | 4         | -46 DB                          | -79                       | -79 |
| 6K                 | 6020                         | 85.5              | 85.5            | 85.3  | 5         | -46 DB                          | -81                       | -82 |
| 8K                 | 8016                         | 83.0              | 83.0            | 83.1  | 5         | -45 DB                          | -83                       | -83 |

|              |    |
|--------------|----|
| PULSE        |    |
| RISE TIME MS | 45 |
| FALL TIME MS | 55 |
| OVERSHOOT MV | 0  |

| ATTENUATOR LINEARITY AT 4 KHZ |     |       |       |      |      |      |      |      |      |      |      |
|-------------------------------|-----|-------|-------|------|------|------|------|------|------|------|------|
|                               | 90  | 80    | 70    | 60   | 50   | 40   | 30   | 20   | 10   | 0    | -10  |
| HTL                           |     |       |       |      |      |      |      |      |      |      |      |
| DB                            | 121 | 111.1 | 101.0 | 91.1 | 81.0 | 71.0 | 61.1 | 51.0 | 41.0 | 30.8 | 20.7 |
| DB ERROR                      | X   | -1    | +1    | -1   | +1   | 0    | -1   | +1   | 0    | +2   | +1   |

Table 5-1 Example Calibration Form

TOTAL ERROR .3 DB

## PART B - MECHANICAL ALIGNMENT

1. Table Adjustments

- a) Insure one rod is rigid on both ends, and opposite rod is floated on each end.
- b) Insure table stop nylon screw is adjusted properly to align with beginning of audiogram card with table fully loaded.
- c) Insure table limit switch bracket is adjusted properly to provide mechanical stop with table fully extended. Should occur within one-tenth of an inch of double line on the end of the audiogram card.
- d) Insure table limit switch, S5, is adjusted for energization at end of audiogram card.
- e) Check program switch wiper for proper tension. Insure program switch is clean and free from lint and dirt.
- f) Check tightness of screws in pinion gear and table drive motor mount.
- g) Check position of program switch, S1, with respect to frequency change lines on audiogram card.
- h) Check position of locating card guide pins to match hole location on audiogram card.

2. Attenuator

- a) Insure wiper exerts uniform pressure on wire-wound surface of attenuator face. Only the silver bar of the wiper should be in contact with the attenuator.

- b) Align 70 dB tap point of attenuator to coincide with 70 dB line on audiogram card by positioning attenuator laterally in slotted holes in attenuator mounting bracket.
- c) Insure 0 dB limit switch is energized when wiper makes contact with shorting bar of attenuator.
- d) Insure 100 dB limit switch is energized when wiper makes contact with 100 dB shorting bar of attenuator.

### 3. Lubrication

- a) Lightly lubricate table rods with silicone grease, Tracor Part No. 76460-0003 (GE Part No. G-330M).
- b) Lubricate attenuator motor, leadscrew, and leadscrew pulley with light machine oil.
- c) Lightly spray surface of program switch S1, with silicon base electrical cleaner.

### 4. Pen Solenoid

- a) Carefully remove plunger, clean and re-assemble.
- b) Do not lubricate.

## SECTION VI

## LIST OF REPLACEABLE PARTS

DATE 05/17/82

| REFERENCE<br>DESIGNATION | T R A C O R<br>STOCK | NUMBER     | DESCRIPTION           | TYPICAL<br>MFGR | MANUFACTURER<br>PART NUMBER    |   |   |   |        |
|--------------------------|----------------------|------------|-----------------------|-----------------|--------------------------------|---|---|---|--------|
| °                        | °                    | °          | ° ASSEMBLY NO         | 9038            | EARPHONE 100 OHM               | ° | ° | ° | °      |
| 2                        |                      | 3901-0001  | HEADBAND              | 78711           | 12A(1TC-89E)                   |   |   |   |        |
| 3                        |                      | 3910-0006  | CORD, PHONE           | 82389           | 4C-4375                        |   |   |   |        |
| 4                        |                      | 3909-0001  | CAP EARPHONE RED      | 19397           | 3909-0001                      |   |   |   | TRACOR |
| 5                        |                      | 3909-0002  | CAP EARPHONE BLU      | 19397           | 3909-0002                      |   |   |   | TRACOR |
| 6                        |                      | 3944-0001  | CUSHION EARPHONE      | 78711           | MX41AR                         |   |   |   |        |
| 7                        |                      | 11051-0002 | PLATE IDENT EARPHONE  | 19397           | 11051-0002                     |   |   |   |        |
| 8                        |                      | 11051-0001 | PLATE IDENT EARPHONE  | 19397           | 11051-0001                     |   |   |   |        |
| A 2                      |                      |            | EARPHONE SET ASSY     | 19397           | 9038                           |   |   |   |        |
| °                        | °                    | °          | ° ASSEMBLY NO         | 9607            | ASSY CONTACT ARM               | ° | ° | ° | °      |
| 1                        |                      | 4239-0024  | SCR PAN HD 4-40X3/8   | 73734           | MS51957-15                     |   |   |   |        |
| 2                        |                      | 4189-0004  | WASHER FLAT NO 4      | 73734           | AN960-C4                       |   |   |   |        |
| 3                        |                      | 3326-0042  | RIVET POP 1/8X.232    | 07707           | AD42B5                         |   |   |   |        |
| 5                        |                      | 6768       | BRACKET WIPER         | 19397           | 6768                           |   |   |   |        |
| 6                        |                      | 9604       | INSULATOR, WIPER      | 19397           | 9604                           |   |   |   |        |
| 7                        |                      | 9603       | CONTACT FINGER        | 19397           | 9603                           |   |   |   |        |
| 8                        |                      | 3914-0078  | WASHER LOCK NO 4      | 73734           | MS35338-135 REPLACE MS35337-78 |   |   |   |        |
| °                        | °                    | °          | ° ASSEMBLY NO         | 18302-0002      | ASSY HAND SWITCH               | ° | ° | ° | °      |
| 2                        |                      | 24331-0001 | GRIP, HANDLE, PLASTIC | 98124           | BR-6955                        |   |   |   |        |
| 3                        |                      | 650-0067   | NUT HEX 15/32-32      | 73734           | 15/32-32X.562AFX.078THK        |   |   |   |        |
| 4                        |                      | 18772-0001 | HOUSING SWITCH        | 19397           | 18772-0001                     |   |   |   |        |
| P 1                      |                      | 76396-0001 | CABLE PHONE JACK      | 19397           | 76396-0001                     |   |   |   |        |
| S 1                      |                      | 24336-0012 | SWITCH PUSHBUTTON     | 21649           | P4-10050/BLK                   |   |   |   | OTTO   |
| °                        | °                    | °          | ° ASSEMBLY NO         | 18887-0001      | ASSY LEADSCREW ARJ-4B          | ° | ° | ° | °      |
| 1                        |                      | 4239-0024  | SCR PAN HD 4-40X3/8   | 73734           | MS51957-15                     |   |   |   |        |
| 2                        |                      | 4129-0006  | WASHER FLAT NO 4      | 80205           | NAS620C4                       |   |   |   |        |
| 3                        |                      | 4724-0008  | SPACER 3/16X1/8       | 06540           | 9207-SS115-0                   |   |   |   |        |
| 4                        |                      | 4239-0008  | SCR PAN HD 4-40X1/8   | 96906           | MS51957-11                     |   |   |   |        |
| 5                        |                      | 751026     | WIPER                 | 19397           | 751026                         |   |   |   |        |
| 6                        |                      | 751025     | INSULATOR             | 19397           | 751025                         |   |   |   |        |
| 7                        |                      | 18883-0003 | LEADSCREW&BUSHING     | 19397           | 18883-0003                     |   |   |   |        |
| 8                        |                      | 76462-0001 | COLLAR SHAFT 3/16 DIA | TC110           | SC-3                           |   |   |   |        |
| 10                       |                      | 18938-0001 | GUIDE BLOCK           | 19397           | 18938-0001                     |   |   |   |        |
| 12                       |                      | 18937-0001 | BRACKET, SOLENOID     | 19397           | 18937-0001                     |   |   |   |        |
| 13                       |                      | 4517-0001  | SCREW FLT 4-40X.187   | 96906           | MS24693-C1 (FF-S-92)           |   |   |   |        |
| 14                       |                      | 4301-0005  | COMPOUND SI HT TRANS  | 05820           | 122                            |   |   |   |        |
| 15                       |                      | 18915-0002 | SOLENOID 17 VDC NOM   | 19397           | 18915-0002                     |   |   |   | TRACOR |
| 16                       |                      | 23695-0003 | SCR SET HEX SOC 2-56  | 96906           | MS51021-3                      |   |   |   |        |
| 17                       |                      | 3872-0039  | NUT HEX 2-56X3/16 AF  | 96906           | MS35649-224                    |   |   |   |        |
| 18                       |                      | 3914-0077  | WASHER LOCK NO 2      | 96906           | MS35338-134                    |   |   |   |        |
| 19                       |                      | 3863-0016  | SEALANT LOCKTITE      | 05972           | 72 BRG MTG (MIL-S-22473)       |   |   |   |        |
| 35                       |                      | 24171-0001 | LUBRICANT OIL         | 17870           | DAVEN OIL                      |   |   |   |        |
| °                        | °                    | °          | ° ASSEMBLY NO         | 18961-0001      | BRACKET ASSY PEN               | ° | ° | ° | °      |
| 1                        |                      | 18945-0001 | BRACKET, PEN          | 19397           | 18945-0001                     |   |   |   |        |
| 2                        |                      | 76345-0002 | CLIP COMPONENT        | 86928           | 4521-38-37-1C                  |   |   |   |        |
| 3                        |                      | 3439-0032  | RIVET FM 3/32X1/8     | 96906           | MS20426 AD3-2                  |   |   |   |        |
| 6                        |                      | 18944-0001 | BUSHING, PEN BRKT     | 19397           | 18944-0001                     |   |   |   |        |
| °                        | °                    | °          | ° ASSEMBLY NO         | 18969-0001      | ASSY TABLE                     | ° | ° | ° | °      |
| 1                        |                      | 18888-0001 | BLOCK, TABLE SLIDE    | 19397           | 18888-0001                     |   |   |   |        |
| 2                        |                      | 3775-0101  | BEARING NYLINED       | 32105           | 6N8-D                          |   |   |   |        |
| 3                        |                      | 6777       | PLATE COVER           | 19397           | 6777                           |   |   |   |        |
| 4                        |                      | 18935-0001 | PLATE                 | 19397           | 18935-0001                     |   |   |   |        |
| 6                        |                      | 3455-0773  | CLAMP CABLE 1/4       | 83330           | 773                            |   |   |   |        |
| 7                        |                      | 3613-0008  | TERMINAL STRIP 3 PIN  | 83330           | 830                            |   |   |   |        |
| 8                        |                      | 3756-0010  | KNGB BLK              | 82389           | M-1178-2                       |   |   |   |        |
| 9                        |                      | 3839-0002  | MOTOR 1 RPM 115/60    | 02770           | 447-1-260-M                    |   |   |   |        |
| 10                       |                      | 23633-0001 | ADHESIVE GEN PURPOSE  | 76381           | SPRA-MENT                      |   |   |   |        |
| 11                       |                      | 6749       | LEVER TABLE           | 19397           | 6749                           |   |   |   |        |
| 12                       |                      | 6761       | PIN LOCATING          | 19397           | 6761                           |   |   |   |        |
| 13                       |                      | 6765       | MOUNT MOTOR           | 19397           | 6765                           |   |   |   |        |
| 15                       |                      | 7460       | SPRING MOTOR          | 19397           | 7460                           |   |   |   |        |
| 16                       |                      | 8555       | ACTUATOR              | 19397           | 8555                           |   |   |   |        |
| 17                       |                      | 3880-5003  | STANDOFF CLINCH TYPE  | 46384           | SOS-632-8                      |   |   |   |        |
| 18                       |                      | 4239-0132  | SCR PAN HD 4-40X1-1/2 | 96906           | MS51957-23                     |   |   |   |        |
| 19                       |                      | 4720-0020  | SPACER AL NO 4X5/16   | 06540           | 9210-A-115-1B                  |   |   |   |        |
| 20                       |                      | 4750-0052  | SPACER AL NO 6X13/16  | 06540           | 9233-A-140-1B                  |   |   |   |        |
| 21                       |                      | 5586-0036  | STANDOFF R 4-40X9/16  | 06540           | 8082-A-0440-1B                 |   |   |   |        |
| 22                       |                      | 5606-0008  | STANDOFF R 6-32X1/8   | 06540           | 8150-A-0632-1B                 |   |   |   |        |
| 23                       |                      | 4239-0012  | SCR PAN HD 4-40X3/16  | 73734           | MS51957-12                     |   |   |   |        |

| LIST OF REPLACEABLE PARTS |                             |                      |                | DATE 05/17/82               |  |  |              |
|---------------------------|-----------------------------|----------------------|----------------|-----------------------------|--|--|--------------|
| REFERENCE<br>DESIGNATION  | T R A C O R<br>STOCK NUMBER | DESCRIPTION          | TYPICAL<br>MFR | MANUFACTURER<br>PART NUMBER |  |  |              |
| 24                        | 4239-0016                   | SCR PAN HD 4-40X1/4  | 73734          | MS51957-13                  |  |  |              |
| 25                        | 4239-0028                   | SCR PAN HD 4-40X7/16 | 73734          | MS51957-16                  |  |  |              |
| 26                        | 4240-0020                   | SCREW PAN 6-32X .312 | 96906          | MS51957-27                  |  |  |              |
| 27                        | 4240-0028                   | SCREW PAN 6-32X .437 | 96906          | MS51957-29                  |  |  |              |
| 28                        | 4240-0040                   | SCREW PAN 6-32X .625 | 96906          | MS51957-31                  |  |  |              |
| 29                        | 4240-0100                   | SCREW PAN 6-32X1     | 96906          | MS51957-34                  |  |  |              |
| 30                        | 240-0016                    | SCREW FIL 4-40X .250 | 73734          | 2232                        |  |  |              |
| 31                        | 4189-0006                   | WASHER FLAT NO 6     | 73734          | AN960-C6                    |  |  |              |
| 32                        | 3869-0183                   | WASHER LOCK INT NO 4 | 73734          | MS35333-70                  |  |  |              |
| 33                        | 3869-0185                   | WASHER LOCK INT NO 6 | 73734          | MS35333-71                  |  |  |              |
| 34                        | 639-0006                    | WASHER NYLON NO 4    | 73734          | 103200                      |  |  |              |
| 35                        | 3872-0119                   | NUT HEX 6-32X5/16 AF | 96906          | MS35649-264                 |  |  |              |
| 36                        | 737-0002                    | NUT CAP 6-32X5/16    | 23050          | 6-32X5/16                   |  |  |              |
| 37                        | 3855-0005                   | RESIN EPOXY          | 10025          | RING EPOXY KIT              |  |  |              |
| 39                        | 23405-0002                  | CLAMP HOSE           | 08484          | QS-100-M32S                 |  |  | BREEZE CORPS |

| ASSEMBLY NO | 18974-0001 | ASSY PROGRAM         | SW MOUNT |             |         |            |  |
|-------------|------------|----------------------|----------|-------------|---------|------------|--|
| 1           | 6852       | RACK                 | 19397    | 6852        |         |            |  |
| 2           | 6770       | HOLDER RACK          | 19397    | 6770        |         |            |  |
| 3           | 4240-0032  | SCREW PAN 6-32X .500 | 96906    | MS51957-30  |         |            |  |
| 4           | 3914-0079  | WASHER LOCK NO 6     | 96906    | MS35333-136 |         |            |  |
| 5           | 6766       | SUPPORT RACK MTG     | 19397    | 6766        |         |            |  |
| 6           | 4239-0024  | SCR PAN HD 4-40X3/8  | 73734    | MS51957-15  |         |            |  |
| 7           | 3914-0078  | WASHER LOCK NO 4     | 73734    | MS35333-135 | REPLACE | MS35337-78 |  |
| 8           | 5056-0040  | STANDOFF H 4-40X5/8  | 83330    | 8404        |         |            |  |

| ASSEMBLY NO | 19475-0001 | PCB ASSY-AUDIO        |       |                             |  |  |        |
|-------------|------------|-----------------------|-------|-----------------------------|--|--|--------|
| 51          | 3878-0051  | HEAT SINK             | 98978 | PA1-1CB                     |  |  |        |
| 52          | 4301-0005  | COMPOUND SI HT TRANS  | 05820 | 122                         |  |  |        |
| 53          | 76329-0001 | SOCKET IC 14 PIN      | 00779 | 583527-1                    |  |  |        |
| 54          | 76329-0002 | SOCKET IC 16 PIN      | 00779 | 583529-1                    |  |  |        |
| 55          | 76329-0003 | SOCKET IC 8 PIN       | 00779 | 583640-1                    |  |  |        |
| 59          | 8819-0020  | WIRE BUS BAR 20 AWG   | 70903 | 8020                        |  |  |        |
| 65          | 19474-0001 | PCB AUDIO             | 19397 | 19474-0001                  |  |  |        |
| 66          | 19473      | DIAGRAM SCHEMATIC AU  | 19397 | 19473                       |  |  |        |
| 69          | 3571-0754  | STRAP TIE DOWN        | 98159 | 2829-75-4                   |  |  |        |
| C 1         | 76410-0001 | CAP FXD MYLAR .0039MF | T0125 | MHR392G2                    |  |  |        |
| C 2         | 3982-0042  | CAP VAR 1000PF        | 34171 | 307                         |  |  |        |
| C 3         | 27512-0150 | CAP FXD MICA 15 PFD   | 00853 | CM05F150G03 (MIL-C-5/18)    |  |  |        |
| C 4         | 27512-0150 | CAP FXD MICA 15 PFD   | 00853 | CM05F150G03 (MIL-C-5/18)    |  |  |        |
| C 5         | 3319-0150  | CAP FXD CER 15 PFD    | 71590 | DD-150                      |  |  |        |
| C 6         | 23195-0027 | CAP FXD TA 22 MFD     | 05397 | T368C226M020AS              |  |  |        |
| C 7         | 76410-0002 | CAP FXD MYLAR .022 MF | T0125 | MHR223G2                    |  |  |        |
| C 8         | 27512-0150 | CAP FXD MICA 15 PFD   | 00853 | CM05F150G03 (MIL-C-5/18)    |  |  |        |
| C 9         | 24113-9102 | CAP FXD CER .1UF      | 72982 | 8131-050-651-104M           |  |  |        |
| C 10        | 3956-0042  | CAP FXD ELEC 50 MFD   | 37942 | T125X50A REPLACES MTA50E25  |  |  |        |
| C 11        | 8916-9331  | CAP FXD TA 3.3 MFD    | 05397 | CS1380335K (MIL-C-26655/2)  |  |  |        |
| C 12        | 24113-9332 | CAP FXD CER .33       | 72982 | 8131-050-651-334M           |  |  |        |
| C 13        | 3956-0013  | CAP FXD ELEC 200 MFD  | 37942 | T125X200 REPLACES MTA200F25 |  |  |        |
| C 14        | 24113-9102 | CAP FXD CER .1UF      | 72982 | 8131-050-651-104M           |  |  |        |
| C 15        | 24113-9102 | CAP FXD CER .1UF      | 72982 | 8131-050-651-104M           |  |  |        |
| C 16        | 76259-0001 | CAP FXD ELEC 1000MFD  | T0127 | ECE-850V1000L               |  |  |        |
| C 17        | 3319-0201  | CAP FXD CER 200 PFD   | 71590 | DD-201                      |  |  |        |
| C 18        | 24113-9102 | CAP FXD CER .1UF      | 72982 | 8131-050-651-104M           |  |  |        |
| C 19        | 23195-0048 | CAP FXD TA 10 MFD     | 05397 | T362B106M025AS              |  |  |        |
| K 1         | 76384-0004 | RELAY REED 2P 12V     | 15636 | RA30692991-01               |  |  |        |
| K 2         | 76384-0005 | RELAY REED 4P 12V     | 15636 | RA30694121-01               |  |  |        |
| K 3         | 76384-0005 | RELAY REED 4P 12V     | 15636 | RA30694121-01               |  |  |        |
| K 4         | 76384-0005 | RELAY REED 4P 12V     | 15636 | RA30694121-01               |  |  |        |
| K 5         | 76384-0005 | RELAY REED 4P 12V     | 15636 | RA30694121-01               |  |  |        |
| K 6         | 76384-0005 | RELAY REED 4P 12V     | 15636 | RA30694121-01               |  |  |        |
| K 7         | 76384-0005 | RELAY REED 4P 12V     | 15636 | RA30694121-01               |  |  |        |
| K 8         | 76384-0003 | RELAY REED 2P 12V     | 15636 | R4328-2                     |  |  |        |
| K 9         | 76384-0003 | RELAY REED 2P 12V     | 15636 | R4328-2                     |  |  |        |
| L 1         | 3925-0004  | SHIELD BEAD           | 02114 | K5 001 00/3B                |  |  |        |
| L 2         | 3925-0004  | SHIELD BEAD           | 02114 | K5 001 00/3B                |  |  |        |
| L 3         | 3925-0004  | SHIELD BEAD           | 02114 | K5 001 00/3B                |  |  |        |
| L 4         | 3925-0004  | SHIELD BEAD           | 02114 | K5 001 00/3B                |  |  |        |
| Q 1         | 900-5459   | TSTR 2N5459           | 04713 | 2N5459                      |  |  |        |
| Q 2         | 900-3906   | TSTR 2N3906           | 01295 | 2N3906                      |  |  |        |
| Q 3         | 900-3906   | TSTR 2N3906           | 01295 | 2N3906                      |  |  |        |
| Q 4         | 900-2270   | TSTR 2N2270           | 01295 | 2N2270                      |  |  |        |
| Q 5         | 900-2270   | TSTR 2N2270           | 01295 | 2N2270                      |  |  |        |
| Q 6         | 900-3904   | TSTR 2N3904           | 04713 | 2N3904                      |  |  |        |
| R 1         | 76338-0026 | RES VAR 50K OHMS      | 80294 | 3299P-1-503                 |  |  | BOURNS |
| R 2         | 76338-0026 | RES VAR 50K OHMS      | 80294 | 3299P-1-503                 |  |  | BOURNS |
| R 3         | 76338-0026 | RES VAR 50K OHMS      | 80294 | 3299P-1-503                 |  |  | BOURNS |
| R 4         | 76338-0026 | RES VAR 50K OHMS      | 80294 | 3299P-1-503                 |  |  | BOURNS |
| R 5         | 76338-0026 | RES VAR 50K OHMS      | 80294 | 3299P-1-503                 |  |  | BOURNS |
| R 6         | 76338-0026 | RES VAR 50K OHMS      | 80294 | 3299P-1-503                 |  |  | BOURNS |
| R 7         | 76338-0026 | RES VAR 50K OHMS      | 80294 | 3299P-1-503                 |  |  | BOURNS |

## LIST OF REPLACEABLE PARTS

DATE 05/17/82

| REFERENCE<br>DESIGNATION | T R A C O R<br>STOCK NUMBER | DESCRIPTION           | TYPICAL<br>MFG | MANUFACTURER<br>PART NUMBER |
|--------------------------|-----------------------------|-----------------------|----------------|-----------------------------|
| R 8                      | 76338-0026                  | RES VAR 50K OHMS      | 80294          | 3299P-1-503 BOURNS          |
| R 9                      | 76338-0026                  | RES VAR 50K OHMS      | 80294          | 3299P-1-503 BOURNS          |
| R 10                     | 76338-0026                  | RES VAR 50K OHMS      | 80294          | 3299P-1-503 BOURNS          |
| R 11                     | 76338-0026                  | RES VAR 50K OHMS      | 80294          | 3299P-1-503 BOURNS          |
| R 12                     | 76338-0026                  | RES VAR 50K OHMS      | 80294          | 3299P-1-503 BOURNS          |
| R 13                     | 212-9091                    | RES FXD FILM 9.09 K   | 81349          | RN6009091F (MIL-R-10509/1)  |
| R 14                     | 212-2001                    | RES FXD FILM 2.00 K   | 81349          | RN6002001F (MIL-R-10509/1)  |
| R 15                     | 212-7870                    | RES FXD FILM 787 OHM  | 81349          | RN6007870F (MIL-R-10509/1)  |
| R 16                     | 212-7500                    | RES FXD FILM 750 OHM  | 81349          | RN6007500F (MIL-R-10509/1)  |
| R 17                     | 212-3320                    | RES FXD FILM 332 OHM  | 81349          | RN6003320F (MIL-R-10509/1)  |
| R 18                     | 212-1372                    | RES FXD FILM 13.7 K   | 81349          | RN6001372F (MIL-R-10509/1)  |
| R 19                     | 212-4532                    | RES FXD FILM 45.3 K   | 81349          | RN6004532F (MIL-R-10509/1)  |
| R 20                     | 212-8661                    | RES FXD FILM 8.66 K   | 81349          | RN6008661F (MIL-R-10509/1)  |
| R 21                     | 212-4021                    | RES FXD FILM 4.02 K   | 81349          | RN6004021F (MIL-R-10509/1)  |
| R 22                     | 212-3401                    | RES FXD FILM 3.40 K   | 81349          | RN6003401F (MIL-R-10509/1)  |
| R 23                     | 212-1691                    | RES FXD FILM 1.69 K   | 81349          | RN6001691F (MIL-R-10509/1)  |
| R 24                     | 212-7152                    | RES FXD FILM 71.5K    | 81349          | RN6007152F (MIL-R-10509/1)  |
| R 25                     | 212-2552                    | RES FXD FILM 25.5K    | 01295          | RN6002552F (MIL-R-10509/1)  |
| R 26                     | 212-7501                    | RES FXD FILM 7.50 K   | 81349          | RN6007501F (MIL-R-10509/1)  |
| R 27                     | 204-0332                    | RES FXD COMP 3.30 K   | 81349          | RC07GF332J (MIL-R-11/8)     |
| R 28                     | 204-0473                    | RES FXD COMP 47.0 K   | 81349          | RC07GF473J (MIL-R-11/8)     |
| R 29                     | 204-0103                    | RES FXD COMP 10.0 K   | 81349          | RC07GF103J (MIL-R-11/8)     |
| R 30                     | 204-0473                    | RES FXD COMP 47.0 K   | 81349          | RC07GF473J (MIL-R-11/8)     |
| R 31                     | 204-0273                    | RES FXD COMP 27.0 K   | 81349          | RC07GF273J (MIL-R-11/8)     |
| R 32                     | 204-0822                    | RES FXD COMP 8.20 K   | 81349          | RC07GF822J (MIL-R-11/8)     |
| R 33                     | 204-0333                    | RES FXD COMP 33.0 K   | 81349          | RC07GF333J (MIL-R-11/8)     |
| R 34                     | 212-3740                    | RES FXD FILM 374 OHM  | 81349          | RN6003740F (MIL-R-10509/1)  |
| R 35                     | 204-0822                    | RES FXD COMP 8.20 K   | 81349          | RC07GF822J (MIL-R-11/8)     |
| R 36                     | 204-0471                    | RES FXD COMP 470 OHM  | 81349          | RC07GF471J (MIL-R-11/8)     |
| R 37                     | 204-0473                    | RES FXD COMP 47.0 K   | 81349          | RC07GF473J (MIL-R-11/8)     |
| R 38                     | 204-0681                    | RES FXD COMP 680 OHM  | 81349          | RC07GF681J (MIL-R-11/8)     |
| R 39                     | 204-0100                    | RES FXD COMP 10.0 OHM | 81349          | RC07GF100J (MIL-R-11/8)     |
| R 40                     | 204-0103                    | RES FXD COMP 10.0 K   | 81349          | RC07GF103J (MIL-R-11/8)     |
| R 41                     | 204-0100                    | RES FXD COMP 10.0 OHM | 81349          | RC07GF100J (MIL-R-11/8)     |
| R 42                     | 212-6491                    | RES FXD FILM 6.49 K   | 81349          | RN6006491F (MIL-R-10509/1)  |
| R 43                     | 212-3091                    | RES FXD FILM 3.09 K   | 81349          | RN6003091F (MIL-R-10509/1)  |
| R 44                     | 201-0471                    | RES FXD COMP 470 OHM  | 81349          | RC20GF471J (MIL-R-11/3)     |
| R 45                     | 204-0333                    | RES FXD COMP 33.0 K   | 81349          | RC07GF333J (MIL-R-11/8)     |
| R 46                     | 201-0471                    | RES FXD COMP 470 OHM  | 81349          | RC20GF471J (MIL-R-11/3)     |
| R 47                     | 204-0334                    | RES FXD COMP 330 K    | 81349          | RC07GF334J (MIL-R-11/8)     |
| R 48                     | 204-0123                    | RES FXD COMP 12.0 K   | 81349          | RC07GF123J (MIL-R-11/8)     |
| R 49                     | 204-0822                    | RES FXD COMP 8.20 K   | 81349          | RC07GF822J (MIL-R-11/8)     |
| R 50                     | 204-0122                    | RES FXD COMP 1.20 K   | 81349          | RC07GF122J (MIL-R-11/8)     |
| R 51                     | 204-0122                    | RES FXD COMP 1.20 K   | 81349          | RC07GF122J (MIL-R-11/8)     |
| R 52                     | 204-0122                    | RES FXD COMP 1.20 K   | 81349          | RC07GF122J (MIL-R-11/8)     |
| R 53                     | 212-1820                    | RES FXD FILM 182 OHM  | 81349          | RN6001820F (MIL-R-10509/1)  |
| R 54                     | 212-1021                    | RES FXD FILM 1.02 K   | 81349          | RN6001021F (MIL-R-10509/1)  |
| R 55                     | 201-0331                    | RES FXD COMP 330 OHM  | 81349          | RC20GF331J (MIL-R-11/3)     |
| R 56                     | 201-0331                    | RES FXD COMP 330 OHM  | 81349          | RC20GF331J (MIL-R-11/3)     |
| R 57                     | 201-0331                    | RES FXD COMP 330 OHM  | 81349          | RC20GF331J (MIL-R-11/3)     |
| R 58                     | 201-0331                    | RES FXD COMP 330 OHM  | 81349          | RC20GF331J (MIL-R-11/3)     |
| R 59                     | 201-0331                    | RES FXD COMP 330 OHM  | 81349          | RC20GF331J (MIL-R-11/3)     |
| R 60                     | 201-0331                    | RES FXD COMP 330 OHM  | 81349          | RC20GF331J (MIL-R-11/3)     |
| R 62                     | 204-0470                    | RES FXD COMP 47.0 OHM | 81349          | RC07GF470J (MIL-R-11/8)     |
| R 63                     | 201-0331                    | RES FXD COMP 330 OHM  | 81349          | RC20GF331J (MIL-R-11/3)     |
| R 64                     | 212-5490                    | RES FXD FILM 549 OHM  | 81349          | RN6005490F (MIL-R-10509/1)  |
| R 65                     | 212-4421                    | RES FXD FILM 4.42 K   | 81349          | RN6004421F (MIL-R-10509/1)  |
| R 66                     | 76338-0025                  | RES VAR 10K OHMS      | 80294          | 3299P-1-103 BOURNS          |
| R 67                     | 76338-0025                  | RES VAR 10K OHMS      | 80294          | 3299P-1-103 BOURNS          |
| R 68                     | 204-0123                    | RES FXD COMP 12.0 K   | 81349          | RC07GF123J (MIL-R-11/8)     |
| R 69                     | 204-0564                    | RES FXD COMP 560 K    | 81349          | RC07GF564J (MIL-R-11/8)     |
| U 1                      | 76387-0001                  | IC LM301AN            | 12040          | LM301AN                     |
| U 2                      | 76387-0001                  | IC LM301AN            | 12040          | LM301AN                     |
| U 3                      | 76387-0001                  | IC LM301AN            | 12040          | LM301AN                     |
| U 4                      | 24686-0011                  | IC CD4011AE           | 02735          | CD4011AE                    |
| U 5                      | 76385-0001                  | IC 7824 VOLT REG      | 07263          | UA7824UC FAIRCHILD          |
| V 1                      | 76379-0002                  | DATA CELL             | 78277          | 301T1-2A2(LED)              |
| CR 1                     | 800-0914                    | DIODE 1N914           | 01295          | 1N914                       |
| CR 2                     | 800-0914                    | DIODE 1N914           | 01295          | 1N914                       |
| CR 3                     | 800-0914                    | DIODE 1N914           | 01295          | 1N914                       |
| CR 4                     | 800-0914                    | DIODE 1N914           | 01295          | 1N914                       |
| CR 5                     | 800-0914                    | DIODE 1N914           | 01295          | 1N914                       |
| CR 6                     | 800-0914                    | DIODE 1N914           | 01295          | 1N914                       |
| CR 7                     | 800-0914                    | DIODE 1N914           | 01295          | 1N914                       |
| CR 8                     | 800-0914                    | DIODE 1N914           | 01295          | 1N914                       |
| CR 9                     | 800-4002                    | DIODE 1N4002          | 04713          | 1N4002                      |
| CR 10                    | 800-4002                    | DIODE 1N4002          | 04713          | 1N4002                      |
| CR 11                    | 800-4002                    | DIODE 1N4002          | 04713          | 1N4002                      |
| CR 12                    | 800-4002                    | DIODE 1N4002          | 04713          | 1N4002                      |
| CR 13                    | 800-0914                    | DIODE 1N914           | 01295          | 1N914                       |
| CR 14                    | 800-0914                    | DIODE 1N914           | 01295          | 1N914                       |
| CR 15                    | 800-0914                    | DIODE 1N914           | 01295          | 1N914                       |
| XQ 1                     | 4608-0005                   | SOCKET TSTR           | 91662          | 05-3303                     |

| LIST OF REPLACEABLE PARTS |                             |                       |                  |                             | DATE 05/17/82              |        |  |  |  |
|---------------------------|-----------------------------|-----------------------|------------------|-----------------------------|----------------------------|--------|--|--|--|
| REFERENCE<br>DESIGNATION  | T R A C O R<br>STOCK NUMBER | DESCRIPTION           | TYPICAL<br>MFG#  | MANUFACTURER<br>PART NUMBER |                            |        |  |  |  |
| ASSEMBLY NO               |                             | 19546-0001            | PCB ASSY+FCFN    | CONT                        |                            |        |  |  |  |
| 20                        | 87-0363                     | LAMP BULB INCD        | 28V              | 08806                       | 1820                       |        |  |  |  |
| 22                        | 76329-0001                  | SOCKET IC 14 PIN      |                  | 00779                       | 583527-1                   |        |  |  |  |
| 24                        | 76376-0001                  | KNGB,SWITCH-LIGHTED   |                  | 22753                       | 99-096-0564                |        |  |  |  |
| 28                        | 19647-0001                  | LABEL                 |                  | 19397                       | 19647-0001                 |        |  |  |  |
| 29                        | 76377-0009                  | LENS,LIGHT FILTER RED |                  | 19397                       | 76377-0009                 |        |  |  |  |
| 30                        | 76377-0007                  | LENS,LIGHTED SW CLR   |                  | 22753                       | 99-096-0578 CLEAR          |        |  |  |  |
| 34                        | 3878-0051                   | HEAT SINK             |                  | 98978                       | PA1-1CB                    |        |  |  |  |
| 35                        | 4301-0005                   | COMPOUND SI HT TRANS  |                  | 05820                       | 122                        |        |  |  |  |
| 36                        | 19545-0001                  | PCB CONTROLLER        |                  | 19397                       | 19545-0001                 |        |  |  |  |
| 37                        | 19547                       | DIA SCH F CONT ARJ-4C |                  | 19397                       | 19547                      | TRACOR |  |  |  |
| 38                        | 3426-0021                   | TUBING TEFLON NO 20   |                  | 70331                       | TFT-200/ZONAT              |        |  |  |  |
| 39                        | 8819-0020                   | WIRE BUS BAR 20 AWG   |                  | 70903                       | 8020                       |        |  |  |  |
| 43                        | 76329-0002                  | SOCKET IC 16 PIN      |                  | 00779                       | 583529-1                   |        |  |  |  |
| 46                        | 23969-0954                  | TAPE PRES SENS 1 WIDE |                  | 76381                       | X-1151                     |        |  |  |  |
| 47                        | 4178-0010                   | STANDOFF RIVET MT     |                  | 71279                       | 1300-10                    |        |  |  |  |
| A 1                       | 76375-0001                  | SWITCH,PB ILLUM       |                  | 22753                       | L5506-322P-00000-X SPECIAL |        |  |  |  |
| C 1                       | 3321-9102                   | CAP FXD CER .1 MFD    |                  | 71590                       | UK10-104                   |        |  |  |  |
| C 2                       | 3321-9102                   | CAP FXD CER .1 MFD    |                  | 71590                       | UK10-104                   |        |  |  |  |
| C 3                       | 3321-9102                   | CAP FXD CER .1 MFD    |                  | 71590                       | UK10-104                   |        |  |  |  |
| C 4                       | 23195-0032                  | CAP FXD TA 10 MFD     |                  | 05397                       | T362B106M015A5             |        |  |  |  |
| C 5                       | 3321-9102                   | CAP FXD CER .1 MFD    |                  | 71590                       | UK10-104                   |        |  |  |  |
| C 6                       | 3321-9102                   | CAP FXD CER .1 MFD    |                  | 71590                       | UK10-104                   |        |  |  |  |
| C 8                       | 3321-9102                   | CAP FXD CER .1 MFD    |                  | 71590                       | UK10-104                   |        |  |  |  |
| C 10                      | 3321-9102                   | CAP FXD CER .1 MFD    |                  | 71590                       | UK10-104                   |        |  |  |  |
| C 11                      | 24183-0471                  | CAP FXD ALUM 470MF    |                  | 73445                       | ET471X040A02               |        |  |  |  |
| C 12                      | 24113-9102                  | CAP FXD CER .1UFD     |                  | 72982                       | 8131-050-651-104M          |        |  |  |  |
| C 13                      | 24113-9102                  | CAP FXD CER .1UFD     |                  | 72982                       | 8131-050-651-104M          |        |  |  |  |
| C 18                      | 3321-9102                   | CAP FXD CER .1 MFD    |                  | 71590                       | UK10-104                   |        |  |  |  |
| C 19                      | 3321-9102                   | CAP FXD CER .1 MFD    |                  | 71590                       | UK10-104                   |        |  |  |  |
| C 20                      | 3321-9102                   | CAP FXD CER .1 MFD    |                  | 71590                       | UK10-104                   |        |  |  |  |
| J 1                       | 76279-0101                  | CONN+PCB 29 POS       |                  | 00779                       | 2-86105-0                  |        |  |  |  |
| Q 1                       | 900-3904                    | TSTR 2N3904           |                  | 04713                       | 2N3904                     |        |  |  |  |
| Q 2                       | 900-3904                    | TSTR 2N3904           |                  | 04713                       | 2N3904                     |        |  |  |  |
| Q 3                       | 900-3904                    | TSTR 2N3904           |                  | 04713                       | 2N3904                     |        |  |  |  |
| Q 4                       | 900-3904                    | TSTR 2N3904           |                  | 04713                       | 2N3904                     |        |  |  |  |
| Q 5                       | 900-3904                    | TSTR 2N3904           |                  | 04713                       | 2N3904                     |        |  |  |  |
| Q 6                       | 900-3904                    | TSTR 2N3904           |                  | 04713                       | 2N3904                     |        |  |  |  |
| Q 7                       | 24130-0004                  | SCR TRIAC SC141D      |                  | 09214                       | SC141D GE ONLY             | GE     |  |  |  |
| Q 8                       | 24130-0004                  | SCR TRIAC SC141D      |                  | 09214                       | SC141D GE ONLY             | GE     |  |  |  |
| Q 9                       | 24130-0004                  | SCR TRIAC SC141D      |                  | 09214                       | SC141D GE ONLY             | GE     |  |  |  |
| R 1                       | 204-0392                    | RES FXD COMP 3.9 K    |                  | 81349                       | RC07GF392J (MIL-R-11/8)    |        |  |  |  |
| R 2                       | 204-0392                    | RES FXD COMP 3.9 K    |                  | 81349                       | RC07GF392J (MIL-R-11/8)    |        |  |  |  |
| R 3                       | 204-0102                    | RES FXD COMP 1.00 K   |                  | 81349                       | RC07GF102J (MIL-R-11/8)    |        |  |  |  |
| R 4                       | 204-0122                    | RES FXD COMP 1.20 K   |                  | 81349                       | RC07GF122J (MIL-R-11/8)    |        |  |  |  |
| R 5                       | 204-0103                    | RES FXD COMP 1.00 K   |                  | 81349                       | RC07GF103J (MIL-R-11/8)    |        |  |  |  |
| R 6                       | 204-0125                    | RES FXD COMP 1.20 MEG |                  | 81349                       | RC07GF125J (MIL-R-11/8)    |        |  |  |  |
| R 7                       | 204-0472                    | RES FXD COMP 4.70 K   |                  | 81349                       | RC07GF472J (MIL-R-11/8)    |        |  |  |  |
| R 8                       | 204-0102                    | RES FXD COMP 1.00 K   |                  | 81349                       | RC07GF102J (MIL-R-11/8)    |        |  |  |  |
| R 9                       | 204-0472                    | RES FXD COMP 4.70 K   |                  | 81349                       | RC07GF472J (MIL-R-11/8)    |        |  |  |  |
| R 10                      | 204-0472                    | RES FXD COMP 4.70 K   |                  | 81349                       | RC07GF472J (MIL-R-11/8)    |        |  |  |  |
| R 11                      | 204-0472                    | RES FXD COMP 4.70 K   |                  | 81349                       | RC07GF472J (MIL-R-11/8)    |        |  |  |  |
| R 13                      | 204-0101                    | RES FXD COMP 100. OHM |                  | 81349                       | RC07GF101J (MIL-R-11/8)    |        |  |  |  |
| R 14                      | 204-0101                    | RES FXD COMP 100. OHM |                  | 81349                       | RC07GF101J (MIL-R-11/8)    |        |  |  |  |
| R 16                      | 202-0621                    | RES FXD COMP 620 OHM  |                  | 81349                       | RC32GF621J (MIL-R-11/6)    |        |  |  |  |
| R 17                      | 204-0332                    | RES FXD COMP 3.30 K   |                  | 81349                       | RC07GF332J (MIL-R-11/8)    |        |  |  |  |
| R 18                      | 204-0332                    | RES FXD COMP 3.30 K   |                  | 81349                       | RC07GF332J (MIL-R-11/8)    |        |  |  |  |
| R 19                      | 204-0472                    | RES FXD COMP 4.70 K   |                  | 81349                       | RC07GF472J (MIL-R-11/8)    |        |  |  |  |
| R 20                      | 204-0472                    | RES FXD COMP 4.70 K   |                  | 81349                       | RC07GF472J (MIL-R-11/8)    |        |  |  |  |
| R 22                      | 202-0621                    | RES FXD COMP 620 OHM  |                  | 81349                       | RC32GF621J (MIL-R-11/6)    |        |  |  |  |
| R 23                      | 204-0101                    | RES FXD COMP 100. OHM |                  | 81349                       | RC07GF101J (MIL-R-11/8)    |        |  |  |  |
| R 28                      | 204-0472                    | RES FXD COMP 4.70 K   |                  | 81349                       | RC07GF472J (MIL-R-11/8)    |        |  |  |  |
| R 30                      | 204-0472                    | RES FXD COMP 4.70 K   |                  | 81349                       | RC07GF472J (MIL-R-11/8)    |        |  |  |  |
| R 31                      | 204-0332                    | RES FXD COMP 3.30 K   |                  | 81349                       | RC07GF332J (MIL-R-11/8)    |        |  |  |  |
| U 1                       | 76436-0001                  | IC NE555              |                  | 18324                       | NE555                      |        |  |  |  |
| U 2                       | 24201-0074                  | IC SN7474N            |                  | 01295                       | SN7474N                    |        |  |  |  |
| U 3                       | 24201-0027                  | IC SN7427N            |                  | 01295                       | SN7427N                    |        |  |  |  |
| U 4                       | 24201-0004                  | IC SN7404N            |                  | 01295                       | SN7404N                    |        |  |  |  |
| U 6                       | 76385-0002                  | IC LM340T-5.0 +5V REG |                  | 12040                       | LM340T-5.0                 |        |  |  |  |
| V 1                       | 76379-0008                  | DATA CELL             |                  | 18178                       | VTL5C2                     |        |  |  |  |
| V 2                       | 76379-0008                  | DATA CELL             |                  | 18178                       | VTL5C2                     |        |  |  |  |
| V 3                       | 76379-0008                  | DATA CELL             |                  | 18178                       | VTL5C2                     |        |  |  |  |
| CR 3                      | 800-0914                    | DIODE 1N914           |                  | 01295                       | 1N914                      |        |  |  |  |
| CR 4                      | 800-0914                    | DIODE 1N914           |                  | 01295                       | 1N914                      |        |  |  |  |
| CR 5                      | 800-0914                    | DIODE 1N914           |                  | 01295                       | 1N914                      |        |  |  |  |
| ASSEMBLY NO               |                             | 19640-1001            | MECH ASSY ARJ-4C |                             |                            |        |  |  |  |
|                           | 9607                        | ASSY CONTACT ARM      | 19397            | 9607                        |                            |        |  |  |  |
|                           | 18969-0001                  | ASSY TABLE            | 19397            | 18969-0001                  |                            |        |  |  |  |
|                           | 18974-0001                  | ASSY+PROGRAM SW MOUNT | 19397            | 18974-0001                  |                            |        |  |  |  |
|                           | 19475-0001                  | PCB ASSY-AUDIO        | 19397            | 19475-0001                  |                            |        |  |  |  |
|                           | 19546-0001                  | PCB ASSY+FCFN CONT    | 19397            | 19546-0001                  |                            |        |  |  |  |

## LIST OF REPLACEABLE PARTS

DATE 05/17/82

| REFERENCE<br>DESIGNATION | T R A C O R<br>STOCK NUMBER | DESCRIPTION           | TYPICAL<br>MEGR | MANUFACTURER<br>PART NUMBER |            |
|--------------------------|-----------------------------|-----------------------|-----------------|-----------------------------|------------|
|                          | 19641-0001                  | RECORDER ASSY ARJ-4C  | 19397           | 19641-0001                  |            |
|                          | 19642-0003                  | HARNES ASSY ARJ-4C    | 19397           | 19642-0003                  | TRACOR     |
|                          | 79089-0001                  | PCB ASSY 6 FREQ SW    | 19397           | 79089-0001                  | TRACOR     |
|                          | 79090-0001                  | PCB ASSY 7 FREQ SW    | 19397           | 79090-0001                  | TRACOR     |
| 1                        | 3905-0001                   | MOUNT RESILIENT       | 72653           | 6081 C OR M                 | G.C.ELEC   |
| 2                        | 3915-0005                   | INSERT THREADED       | 94222           | 72-1-832-13                 |            |
| 3                        | 3326-0043                   | RIVET POP 1/8X294     | 07707           | AD4385                      |            |
| 4                        | 19644-0001                  | PLATE BASE            | 19397           | 19644-0001                  |            |
| 7                        | 18986-0001                  | BRACKET LIMIT SW      | 19397           | 18986-0001                  |            |
| 9                        | 76416-0001                  | CLIP, RETAINER        | 00779           | 86694-8                     |            |
| 11                       | 19645-0001                  | BRKT SWITCH MTG       | 19397           | 19645-0001                  |            |
| 13                       | 3455-0771                   | CLAMP CABLE 1/8       | 83330           | 771                         |            |
| 14                       | 383-0032                    | SCR BND HD 10-32X.500 | 73734           | NYLON, STL CAD PL           |            |
| 15                       | 18939-0002                  | TABLE, ROD            | 19397           | 18939-0002                  |            |
| 16                       | 76367-0001                  | TRANSFORMER 12/24 V   | 97965           | P-6377                      |            |
| 17                       | 18947-0001                  | BRACKET SWITCH        | 19397           | 18947-0001                  |            |
| 18                       | 76432-0001                  | ACTUATOR, SWITCH      | 91929           | JS-221                      |            |
| 19                       | 3624-0006                   | LUG SOLDER NO 6       | 73734           | 38-111                      |            |
| 20                       | 5046-0024                   | STANDOFF H 4-40X3/8   | 83330           | 8402                        |            |
| 22                       | 3455-0772                   | CLAMP CABLE 3/16      | 83330           | 772                         |            |
| 23                       | 3763-0031                   | WASHER SHOULDER 3/8   | 86928           | 5604-31                     |            |
| 24                       | 76339-0879                  | HOLDER FUSE BLK/GRY   | 75915           | 348879                      | LITTELFUSE |
| 25                       | 3348-9101                   | FUSE 1 AMP 250 VOLT   | 75915           | 312001                      |            |
| 26                       | 32115-0012                  | GRUMMET, HEYCD        | 19397           | 32115-0012                  |            |
| 27                       | 3801-0074                   | CORD ELEC HOSP GRADE  | 80126           | C-4700                      | PAC ELEC   |
| 29                       | 3801-0004                   | CABLE 23AWG 21/36STRD | 70903           | 8495                        |            |
| 30                       | 525-0040                    | SCREW FIL 10-32X .625 | 73734           | 102356                      |            |
| 31                       | 4129-0005                   | WASHER FLAT NO 4      | 80205           | NA5620C4L                   |            |
| 32                       | 19634-0001                  | PANEL, REAR           | 19397           | 19634-0001                  |            |
| 35                       | 24171-0001                  | LUBRICANT OIL         | 17870           | DAVEN OIL                   |            |
| 37                       | 5050-0016                   | STANDOFF H 4-40X1/4   | 06540           | 8102-SS-0440-7              |            |
| 38                       | 4049-0015                   | STRAP TIE DOWN        | 06383           | SST-1                       |            |
| 40                       | 641-0037                    | WASHER FLAT .251 ID   | 86928           | 5612-37-5                   |            |
| 203                      | 350-0008                    | SCREW SET 4-40X .125  | 73734           | HT TR STL, CUP PT           |            |
| 204                      | 19662-0001                  | GEAR                  | 19397           | 19662-0001                  |            |
| 207                      | 6836                        | GEAR                  | 19397           | 6836                        |            |
| CR 1                     | 3432-0008                   | DIODE J-4 1A 400PIV   | 12060           | J-4                         | DIODES     |

| ASSEMBLY NO | 19641-0001             | RECORDER ASSY ARJ-4C  |            |                                |          |
|-------------|------------------------|-----------------------|------------|--------------------------------|----------|
| 18887-0001  | ASSY, LEADSCREW ARJ-4B | 19397                 | 18887-0001 |                                |          |
| 18961-0001  | BRACKET ASSY PEN       | 19397                 | 18961-0001 |                                |          |
| 751318      | LINEAR ATTN ASSY       | 19397                 | 751318     |                                |          |
| 1           | 76471-2007             | WASHER FLT SST 3/8 ID | 86928      | 5710-180-5                     | SEASTROM |
| 3           | 3801-4002              | CABLE ASSY RETRACTILE | T0005      | 4002                           |          |
| 4           | 3839-1847              | MOTOR SNY 300RPM 60HZ | 82227      | K81701                         |          |
| 5           | 19646-0001             | PLATE SIDE            | 19397      | 19646-0001                     |          |
| 6           | 76361-0001             | FASTENER WELL NUT     | 07707      | BXE-632 W/SCREW                |          |
| 7           | 350-0012               | SCREW SET 4-40X .187  | 73734      | HT TR STL, CUP PT              |          |
| 9           | 751143                 | BRKT ATTN MTG         | 19397      | 751143                         |          |
| 10          | 6759                   | SPACER UPPER UNIT     | 19397      | 6759                           |          |
| 11          | 6760                   | POST UPPER UNIT REAR  | 19397      | 6760                           |          |
| 12          | 3625-2001              | NUT CLINCH 4-40       | 46384      | F-440-1                        |          |
| 13          | 3814-2138              | GASKET O-RING NITRILE | 77308      | NITRILE H-90 2 1/8X2 5/16X3/32 |          |
| 14          | 3845-0001              | BEARING FLG-TYPE BRZ  | 90052      | FB-25-2                        |          |
| 16          | 18946-0001             | LIFTING LINK          | 19397      | 18946-0001                     |          |
| 18          | 19550-0001             | PULLEY, ATTN MOTOR    | 19397      | 19550-0001                     |          |
| 19          | 19550-0002             | PULLEY                | 19397      | 19550-0002                     |          |
| 21          | 76368-0001             | PEN MARKING BLK NYLON | 88920      | 80-16-1161-99                  |          |
| 22          | 754095                 | ROD PIVOT STYLUS      | 19397      | 754095                         |          |
| 24          | 3775-0006              | BEARING NYLON         | 93990      | 3-FN-5                         |          |
| 25          | 19643                  | WIRE LIST             | 19397      | 19643                          |          |
| 27          | 19646-0002             | PLATE SIDE            | 19397      | 19646-0002                     |          |
| 35          | 24171-0001             | LUBRICANT OIL         | 17870      | DAVEN OIL                      |          |

| ASSEMBLY NO | 19642-0003 | HARNES ASSY ARJ-4C    |       |                         |        |
|-------------|------------|-----------------------|-------|-------------------------|--------|
| 8           | 76276-0001 | CONTACT ELEC 24-22AWG | 00779 | 86561-7 (TOOL 90222-61) | AMP    |
| 15          | 4299-0039  | CONNECTOR ADAPTOR     | 79061 | 67202                   |        |
| 16          | 4049-0015  | STRAP TIE DOWN        | 06383 | SST-1                   |        |
| 17          | 23490-0003 | WIRE SHIELDED         | T0058 | 1C24SPJ                 |        |
| 18          | 3801-0003  | CABLE 22AWG 7/30 STRD | 70903 | 8451                    |        |
| 19          | 8819-0022  | WIRE BUS BAR 22 AWG   | 70903 | 8021                    |        |
| 39          | 4529-2202  | WIRE 22AWG BLK        | 70903 | 8530 BLK                |        |
| 43          | 3426-0021  | TUBING TEFLON NO 20   | 70331 | TFT-200/20NAT           |        |
| 45          | 19547      | DIA SCH F CONT ARJ-4C | 19397 | 19547                   | TRACOR |
| C 2         | 76321-0019 | CAP FXD MYLAR .68 UF  | 22213 | MLF684K4 .44D X1.05L    |        |
| J 1         | 3648-0011  | JACK EARPHONE         | 82389 | 128                     |        |
| J 2         | 3648-0006  | CONN SOC ELECT        | 71785 | S-304AB                 |        |
| J 3         | 3648-0011  | JACK EARPHONE         | 82389 | 128                     |        |
| J 5         | 3628-0022  | CONNECTOR PCB 22 PIN  | 71785 | 50-22A-20               |        |
| J 6         | 76513-0212 | CONN/HOUSING .1 CEN   | 00779 | 1-640440-2              | AMP    |
| P 2         | 76277-0003 | CONN, CABLE-ELECT 29P | 00779 | 86555-3                 |        |

## LIST OF REPLACEABLE PARTS

DATE 05/17/82

| REFERENCE<br>DESIGNATION | T R A C O R<br>STOCK NUMBER | DESCRIPTION           | TYPICAL<br>MFR      | MANUFACTURER<br>PART NUMBER    |
|--------------------------|-----------------------------|-----------------------|---------------------|--------------------------------|
| R 1                      | 203-0911                    | RES FXD COMP 910 OHM  | 81349               | RC42GF911J (MIL-R-11/71)       |
| S 2                      | 76366-0002                  | SWITCH, SNAP          | 91929               | 115M1-T2                       |
| S 3                      | 76366-0002                  | SWITCH, SNAP          | 91929               | 115M1-T2                       |
| S 4                      | 3633-0001                   | SWITCH SLIDE          | 82389               | 46256LF                        |
| S 5                      | 76366-0002                  | SWITCH, SNAP          | 91929               | 115M1-T2                       |
| S 6                      | 26690-7101                  | SWITCH, TOGGLE        | 09353               | 7101SYZBE                      |
| TB 2                     | 3613-0029                   | TERMINAL STRIP 8 PIN  | 83330               | 900                            |
| TB 3                     | 3613-0003                   | TERMINAL STRIP 1 PIN  | 83330               | 813                            |
| ° ° ° °                  | ASSEMBLY NO                 | 19650-0001            | ARJ-4C/7 AUDIOMETER | ° ° ° °                        |
|                          | 19650-1001                  | ASSY ARJ-4C INTMD     | 19397               | 19650-1001                     |
|                          |                             |                       |                     | TRACOR                         |
| ° ° ° °                  | ASSEMBLY NO                 | 19650-0006            | ARJ-4C/6 AUDIOMETER | ° ° ° °                        |
|                          | 19650-1001                  | ASSY ARJ-4C INTMD     | 19397               | 19650-1001                     |
|                          |                             |                       |                     | TRACOR                         |
| ° ° ° °                  | ASSEMBLY NO                 | 19650-0010            | ARJ-4C 0-100 DB HTL | ° ° ° °                        |
|                          | 19650-1001                  | ASSY ARJ-4C INTMD     | 19397               | 19650-1001                     |
|                          |                             |                       |                     | TRACOR                         |
| ° ° ° °                  | ASSEMBLY NO                 | 19650-1001            | ASSY ARJ-4C INTMD   | ° ° ° °                        |
|                          | 9038                        | EARPHONE SET ASSY     | 19397               | 9038                           |
|                          | 19640-1001                  | MECH ASSY ARJ-4C      | 19397               | 19640-1001                     |
|                          | 19663-0001                  | ACCESSORY ASSY        | 19397               | 19663-0001                     |
| 1                        | 3326-0032                   | RIVET POP 3/32X.212   | 07707               | AD32B5                         |
| 2                        | 6152-1001                   | PLATE, IDENT          | 19397               | 6152-1001                      |
| 6                        | 19547                       | DIA SCH F CONT ARJ-4C | 19397               | 19547                          |
| 7                        | 19473                       | DIAGRAM, SCHEMATIC AU | 19397               | 19473                          |
| 8                        | 19548                       | DIAGRAM, SCH-INTERCON | 19397               | 19548                          |
| 11                       | 19661-0001                  | PANEL, DECORATIVE     | 19397               | 19661-0001                     |
| 15                       | 79649-0001                  | CASE ARJ-4C           | 19397               | 79649-0001                     |
| 16                       | 19620-0001                  | COVER RECESS          | 19397               | 19620-0001                     |
| 17                       | 3666-0122                   | BUMPER PLASTIC GRAY   | T0229               | 0943-0413 GRAY                 |
| 18                       | 3663-0412                   | HANDLE                | 19397               | 3663-0412                      |
| 19                       | 76484-0017                  | TAPE FOAM DBL HI-TACK | 76381               | 4042 (1/2 WIDE)                |
| 20                       | 91-1122                     | NUT RIVET 4-40        | 03481               | A4-85                          |
| 21                       | 19670-0011                  | PAD, SHIPPING         | 19397               | 19670-0011                     |
| 22                       | 19787-0001                  | LABEL, SHIPPING PAD   | 19397               | 19787-0001                     |
| 23                       | 19503-0002                  | LABEL AUDIOMETER      | 19397               | 19503-0002                     |
| 24                       | 19661-0002                  | PANEL DECORATIVE      | 19397               | 19661-0002                     |
| 25                       | 19670-0140                  | LABEL 0-100 DB HL     | 19397               | 19670-0140                     |
|                          |                             |                       |                     | TRACOR                         |
| ° ° ° °                  | ASSEMBLY NO                 | 19663-0001            | ACCESSORY ASSY      | ° ° ° °                        |
|                          | 18302-0002                  | ASSY HAND SWITCH      | 19397               | 18302-0002                     |
|                          | 19784-0001                  | ASSY, LAMP REMOVER    | 19397               | 19784-0001                     |
| 2                        | 19571-0001                  | AUDIOGRAM CARD        | 19397               | 19571-0001                     |
| 3                        | 19685-0001                  | BAG FABRIC            | 19397               | 19685-0001                     |
| 4                        | 18738-0001                  | AUDIOMETRIC TEST CARD | 19397               | 18738-0001                     |
| 5                        | 19570-0001                  | OPERATING GUIDE BOOK  | 19397               | 19570-0001                     |
| 6                        | 76368-0001                  | PEN MARKING BLK NYLON | 88920               | 80-16-1161-99                  |
| 7                        | 76368-0002                  | PEN MARKING RED NYLON | 88920               | 80-16-1162-99                  |
| 9                        | 87-0363                     | LAMP BULB INCO 28V    | 08806               | 1820                           |
| 10                       | 3814-2138                   | GASKET O-RING NITRILE | 77308               | NITRILE H-90 2 1/8X2 5/16X1/32 |
| 11                       | 19571-0002                  | AUDIOGRAM CARD        | 19397               | 19571-0002                     |
| 12                       | 18563-0001                  | AUDIOGRAM CARD        | 19397               | 18563-0001                     |
| 13                       | 19761-0001                  | AUDIOGRAM CARD        | 19397               | 19761-0001                     |
|                          |                             |                       |                     | TRACOR                         |
| ° ° ° °                  | ASSEMBLY NO                 | 19784-0001            | ASSY, LAMP REMOVER  | ° ° ° °                        |
| 1                        | 94-0030                     | TUBING IHS #375ID BLK | 70331               | FIT-221-3/8                    |
| 2                        | 23251-0011                  | AL TBE 2024-T3        | 81348               | WW-T-700/3 .312 X .197         |
| 3                        | 19785-0002                  | MANDREL               | 19397               | 19785-0002                     |
| ° ° ° °                  | ASSEMBLY NO                 | 79089-0001            | PCB ASSY 6 FREQ SW  | ° ° ° °                        |
| 1                        | 18895                       | PCB, PROG SW 6 FREQ   | 19397               | 18895                          |
| 2                        | 76514-0012                  | POST HEADER #1 CENTER | 00779               | 1-640098-2                     |
|                          |                             |                       |                     | TRACOR<br>AMP                  |
| ° ° ° °                  | ASSEMBLY NO                 | 79090-0001            | PCB ASSY 7 FREQ SW  | ° ° ° °                        |
| 1                        | 19539                       | PCB, PROG SW 7 FREQ   | 19397               | 19539                          |
| 2                        | 76514-0012                  | POST HEADER #1 CENTER | 00779               | 1-640098-2                     |
|                          |                             |                       |                     | TRACOR<br>AMP                  |

Drive  
Belt

| LIST OF REPLACEABLE PARTS |             |              |   |                       |         | DATE 05/17/82               |                 |      |         |
|---------------------------|-------------|--------------|---|-----------------------|---------|-----------------------------|-----------------|------|---------|
| REFERENCE                 | T R A C O R | STOCK NUMBER |   | DESCRIPTION           | TYPICAL | MANUFACTURER                |                 |      |         |
| DESIGNATION               |             |              |   |                       | MFGR    | PART NUMBER                 |                 |      |         |
| +                         | +           | +            | + | ASSEMBLY NO           | 751318- | LINEAR                      | ATTN            | ASSY | +       |
| 1                         |             | 201-0100     |   | RES FXD COMP 10 OHM   | 01121   | RC20GF100J                  | (MIL-R-11/3)    |      |         |
| 2                         |             | 201-0270     |   | RES FXD COMP 27.0 OHM | 81349   | RC20GF270J                  | (MIL-R-11/3)    |      |         |
| 3                         |             | 201-0620     |   | RES FXD COMP 62.0 OHM | 81349   | RC20GF620J                  | (MIL-R-11/3)    |      |         |
| 4                         |             | 205-1000     |   | RES FXD FILM 100. OHM | 81349   | RN65D1000F                  | (MIL-R-10509/21 |      |         |
| 5                         |             | 204-0101     |   | RES FXD COMP 100. OHM | 81349   | RC07GF101J                  | (MIL-R-11/8)    |      |         |
| 6                         |             | 214-0470     |   | RES FXD WW 47 OHM     | 81349   | RW59V470                    |                 |      |         |
| 7                         |             | 4238-0032    |   | SCR PAN HD 2-56X1/2   | 96906   | MS51957-7                   |                 |      |         |
| 8                         |             | 610-0201     |   | TERMINAL SOLDER       | T0099   | 160-1558-04-01-00           |                 |      | CAMBION |
| 9                         |             | 3869-0181    |   | WASHER LOCK INT NO 2  | 96906   | MS35333-69                  |                 |      |         |
| 10                        |             | 3872-0039    |   | NUT HEX 2-56X3/16 AF  | 96906   | MS35649-224                 |                 |      |         |
| 11                        |             | 3426-0021    |   | TUBING TEFLON NO 20   | 70331   | TFT-200/20NAT               |                 |      |         |
| 12                        |             | 3679-0001    |   | WIRE RESISTANCE       | 19397   | 3679-0001                   |                 |      | TRACOR  |
| 13                        |             | 3753-0003    |   | EYELET                | 72653   | 7253 C                      |                 |      |         |
| 15                        |             | 3877-0004    |   | TERMINAL SOLDER       | 88245   | 1300 D                      |                 |      |         |
| 16                        |             | 3886-0016    |   | TAPE PRESS SENS 1/4   | 76381   | 465                         |                 |      |         |
| 18                        |             | 6822         |   | BOARD                 | 19397   | 6822                        |                 |      |         |
| 19                        |             | 6823         |   | BOARD                 | 19397   | 6823                        |                 |      |         |
| 20                        |             | 8819-0018    |   | WIRE BUS BAR 18 AWG   | 70903   | 8019                        |                 |      |         |
| 21                        |             | 8819-0022    |   | WIRE BUS BAR 22 AWG   | 70903   | 8021                        |                 |      |         |
| 22                        |             | 751013       |   | SPACER                | 19397   | 751013                      |                 |      |         |
| 23                        |             | 751178       |   | BAR COMMON SILVER     | 19397   | 751178                      |                 |      |         |
| 27                        |             | 4468-0005    |   | ADHESIVE INSULATING   | 07707   | USM CLEAR ROD TYPE HOT MELT |                 |      |         |
| 28                        |             | 17437-0001   |   | TERMINAL FEED-THRU    | 19397   | 17437-0001                  |                 |      |         |
| 29                        |             | 23285-0002   |   | SCR FIL HD 0-80X1/8   | 73734   | CRES 0-80X1/8               |                 |      |         |
| 30                        |             | 751181       |   | BAK SILVER CONTACT    | 19397   | 751181                      |                 |      |         |
| 35                        |             | 24171-0001   |   | LUBRICANT OIL         | 17870   | DAVEN OIL                   |                 |      |         |



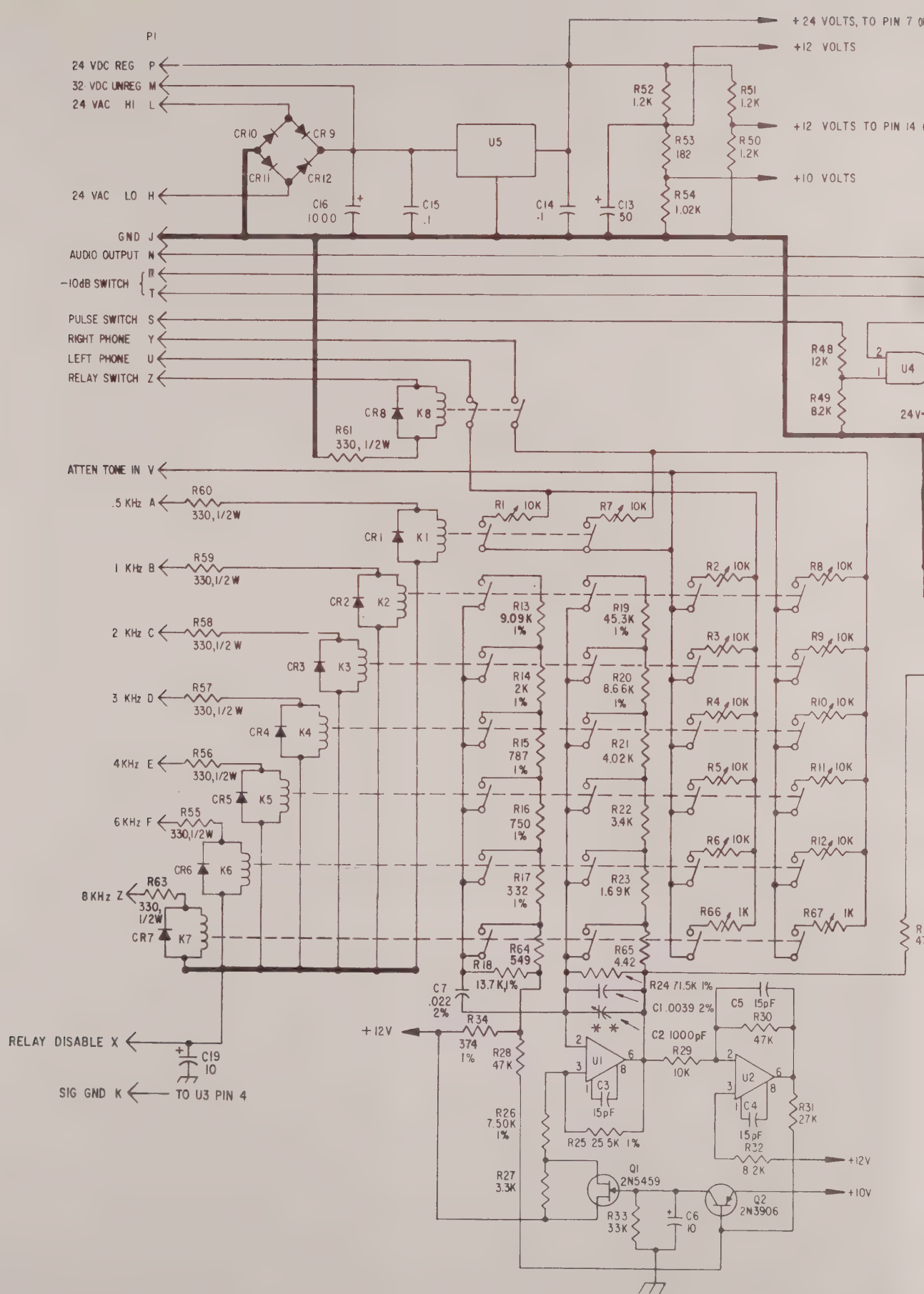
## SECTION VII

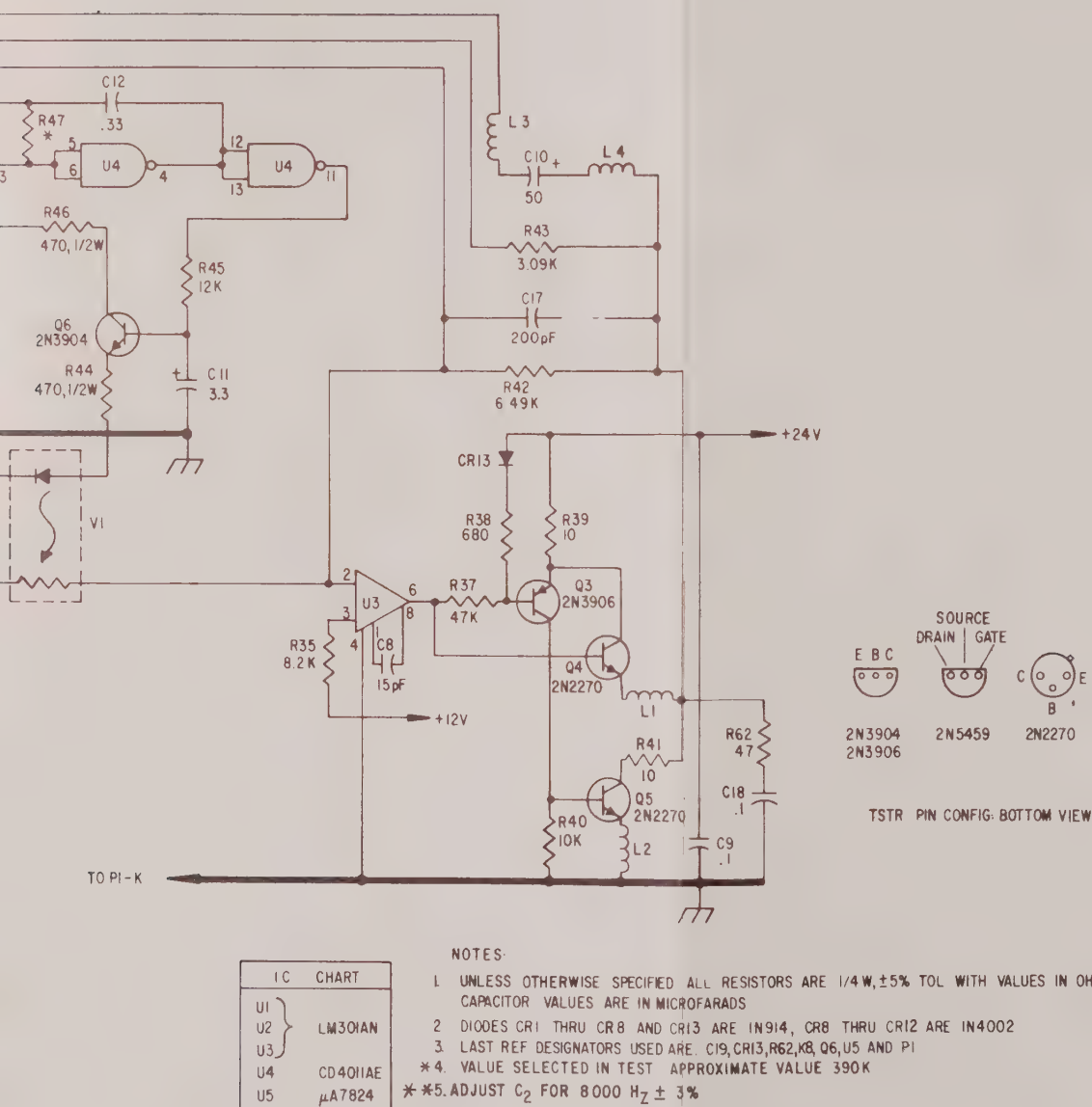
## FEDERAL SUPPLY MANUFACTURERS CODES

## MANUAL LISTING OF FEDERAL SUPPLY CODES FOR MANUFACTURERS

| CODE  | MANUFACTURER                                               |                                 |
|-------|------------------------------------------------------------|---------------------------------|
| T0005 | RUSSELL INDUSTRIES INC                                     | LYNBROOK I L N Y                |
| T0025 | RING CHEMICAL CO                                           | HOUSTON TEXAS                   |
| T0058 | BUSACKER/HAMILTON ELECTRO CORP.                            | HOUSTON TEX                     |
| T0099 | CAMBION                                                    | CAMBRIDGE, MASS                 |
| T0110 | SMALL PARTS INC.                                           | MIAMI, FLA                      |
| T0125 | QUANTOM-THAYER                                             | HOUSTON TEX                     |
| T0127 | MATSUSHITA ELECTRONICS CORP                                | NEW YORK, NY                    |
| T0229 | BRUCE PLASTICS INC                                         | PITTSBURGH PA                   |
| 00779 | AMP INC                                                    | HARRISBURG PA                   |
| 00853 | SANGAMO ELECTRIC CO PICKENS DIVISION                       | PICKENS S C                     |
| 01121 | ALLEN-BRADLEY CO                                           | MILWAUKEE WIS                   |
| 01295 | TEXAS INSTRUMENTS INC SEMICONDUCTOR-COMPONENTS DIVISION    | DALLAS TEX                      |
| 02114 | FERROXCUBE CORP OF AMERICA                                 | SAUGERTIES N Y                  |
| 02735 | RADIO CORP OF AMERICA SOLID STATE AND REC TUBE DIV         | SOMERVILLE N J                  |
| 02770 | BRISTOL MOTORS DIV OF VOCALINE CO OF AMERICA               | OLD SAYBROOK CONN               |
| 03481 | GOODRICH B F CO AEROSPACE AND DEFENSE PRODUCTS DIVISION    | AKRON OHIO                      |
| 04713 | MOTOROLA SEMICONDUCTOR PRODUCTS INC                        | PHOENIX ARIZ                    |
| 05397 | UNION CARBIDE CORP ELECTRONICS DIV                         | CLEVELAND OHIO                  |
| 05820 | WAKEFIELD ENGINEERING INC                                  | WAKEFIELD MASS                  |
| 05972 | LOCTITE CORP                                               | NEWINGTON CONN                  |
| 06383 | PANDUIT CORP.                                              | TINLEY PARK ILL                 |
| 06540 | AMATOM ELECTRONIC HARDWARE CO INC                          | NEW ROCHELLE N Y                |
| 07263 | FAIRCHILD CAMERA AND INST CORP SEMICONDUCTOR DIV           | MOUNTAIN VIEW CALIF             |
| 07707 | UNITED SHOE MACHINERY CORP FASTENER DIVISION               | SHELTON CONN                    |
| 08484 | BREEZE CORPORATIONS INC                                    | UNION, NJ                       |
| 08806 | GENERAL ELECTRIC CO MINIATURE LAMP DEPT                    | CLEVELAND OHIO                  |
| 09214 | GENERAL ELECTRIC CO SEMICONDUCTOR PRODUCTS DEPT            | AUBURN N Y                      |
| 09353 | C AND K COMPONENTS INC                                     | NEWTON MASS                     |
| 12040 | NATIONAL SEMICONDUCTOR CORP.                               | DANBURY CONN                    |
| 12060 | DIODES INC                                                 | CHATSWORTH CALIF                |
| 15636 | ELEC-TROL INC                                              | SAUGUS, CA                      |
| 17870 | DAVEN DIV THOMAS A EDISON INDUSTRIES MCGRAW-EDISON CO      | MANCHESTER N H                  |
| 18178 | VACTEC INC                                                 | MARYLAND HEIGHTS, MD            |
| 18324 | SIGNETICS CORP                                             | SUNNYVALE CALIF                 |
| 19397 | TRACOR INC                                                 | AUSTIN TEX                      |
| 21649 | OTTO CONTROLS                                              | MORTON GROVE ILL                |
| 22213 | THAYER CORP                                                | CLEVELAND OHIO                  |
| 22753 | UIC ELECTRONICS CORP                                       | HOLLYWOOD, FL                   |
| 23050 | PRODUCT COMPONENTS CORPORATION                             | HASTINGS-ON-HUDSON N Y          |
| 32105 | THOMSON INDUSTRIES INC                                     | WASHINGTON, NY                  |
| 37942 | MALLORY P R AND CO INC                                     | INDIANAPOLIS IND                |
| 46384 | PENN ENGINEERING AND MFG CORP                              | DOYLESTOWN PA                   |
| 70331 | ALPHA WIRE CORP-XCELLED USE 92194                          | ELIZABETH NJ                    |
| 70903 | BELDEN MFG CO                                              | CHICAGO ILL                     |
| 71279 | CAMBRIDGE THERMIONIC CORP                                  | CAMBRIDGE MASS                  |
| 71590 | CENTRALAB DIVISION OF GLOBE-UNION INC                      | MILWAUKEE WIS                   |
| 71785 | CINCH MFG CO AND HOWARD B JONES DIV                        | CHICAGO ILL                     |
| 72653 | G C ELECTRONICS MFG CO                                     | ROCKFORD ILL                    |
| 72982 | ERIE TECHNOLOGICAL PRODUCTS INC                            | ERIE PA                         |
| 73445 | AMPEREX ELECTRONIC CO DIV OF NORTH AMERICAN PHILIPS CO INC | HICKSVILLE N Y                  |
| 73734 | FEDERAL SCREW PRODUCTS CORP                                | CHICAGO ILL                     |
| 75915 | LITTELFUSE INC                                             | DES PLAINES ILL                 |
| 76381 | MINNESOTA MINING AND MFG CO                                | ST PAUL MINN                    |
| 77308 | PLASTIC AND RUBBER PRODUCTS                                | LOS ANGELES CALIF               |
| 78277 | SIGMA INSTRUMENTS INC                                      | SO BRAINTREE MASS               |
| 78711 | TELEPHONICS DIV OF INSTRUMENT SYSTEMS CORP                 | HUNTINGTON N Y                  |
| 79061 | VACO PRODUCTS INC                                          | CHICAGO ILL                     |
| 80126 | PACIFIC ELECTRICORD CO                                     | GARDENA CALIF                   |
| 80205 | NATL AEROSPACE STD COMMITTEE AERO IND ASSOC OF AMERICA     | WASHINGTON DC                   |
| 80294 | BOURNS LABORATORIES INC                                    | RIVERSTIDE CALIF                |
| 81348 | FEDERAL SPECIFICATIONS                                     | GENERAL SERVICES ADMINISTRATION |
| 81349 | MILITARY SPECIFICATIONS                                    | STD DIV DIR OF LOG SER DSA      |
| 82227 | HAYDON A W CO                                              | WATERBURY CONN                  |
| 82389 | SWITCHCRAFT INC                                            | CHICAGO ILL                     |
| 83330 | SMITH HERMAN H INC                                         | BROOKLYN N Y                    |
| 84171 | ARCO ELECTRONICS INC                                       | GREAT NECK N Y                  |
| 86928 | SEASTROM MFG CO INC                                        | GLENDALE CALIF                  |
| 88245 | LITTON INDUSTRIES, USECO DIV                               | VAN NUYS, CALIF                 |
| 88920 | GRAPHIC CONTROLS CORP DETROIT DIV                          | LATHRUP VILLAGE MICH            |
| 90052 | BOSTON GEAR WORKS DIV OF MURRAY CO OF TEXAS                | PHILADELPHIA PA                 |
| 91662 | ELCO CORP                                                  | WILLOW GROVE PA                 |
| 91929 | HONEYWELL INC MICROSWITCH DIV                              | FREEDPORT ILL                   |
| 93990 | CLIMAX METAL PRODUCTS                                      | CLEVELAND OHIO                  |
| 94222 | SOUTH CHESTER CORP                                         | CHESTER PA                      |
| 96906 | MILITARY STANDARD %MSC DRAWINGS                            | STD DIV DIR OF LOG SER DSA      |
| 97965 | STANCOR ELECTRONICS INC                                    | CHICAGO ILL                     |
| 98124 | HUNT-WILDE CORP                                            | DAYTON OHIO                     |
| 98159 | RUBBER TEK INC                                             | GARDENA CALIF                   |
| 98978 | INTERNATIONAL ELECTRONIC RESEARCH CORP                     | BURBANK CALIF                   |

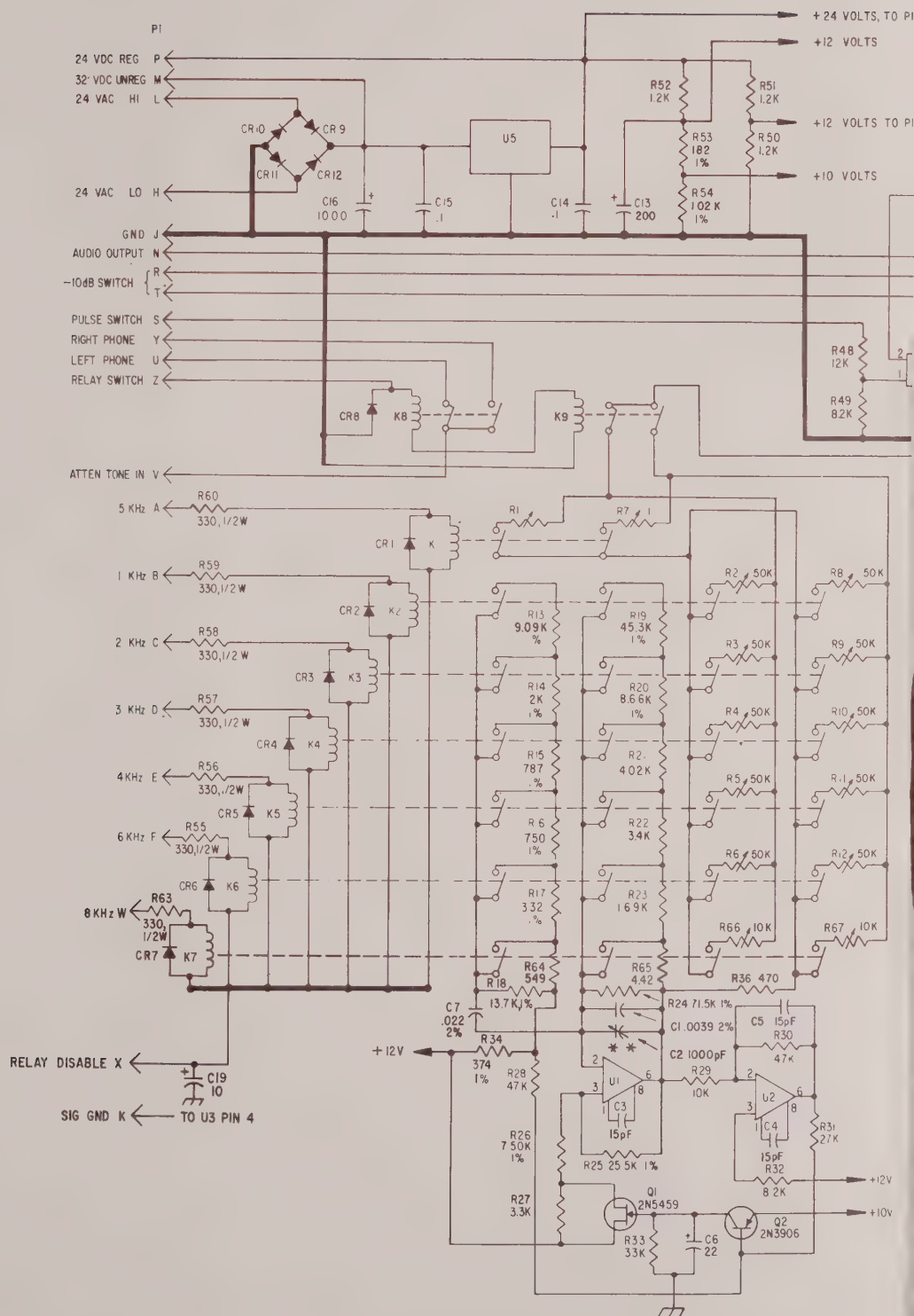






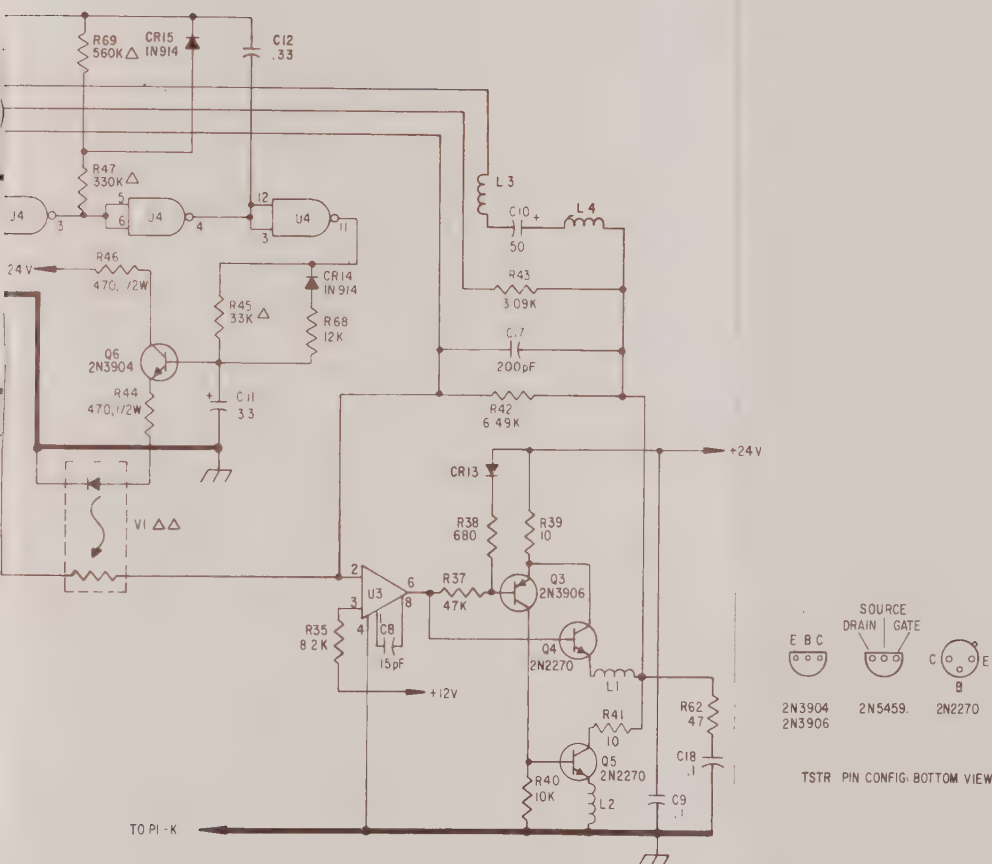
EFFECTIVITY; ARJ-4C SN 0101-0250

Figure 9 Diagram Schematic, Audio  
PCB ARJ-4C, Drawing No.  
19544 E



1 7 OF U1, U2 &amp; U3

1 4 OF U4



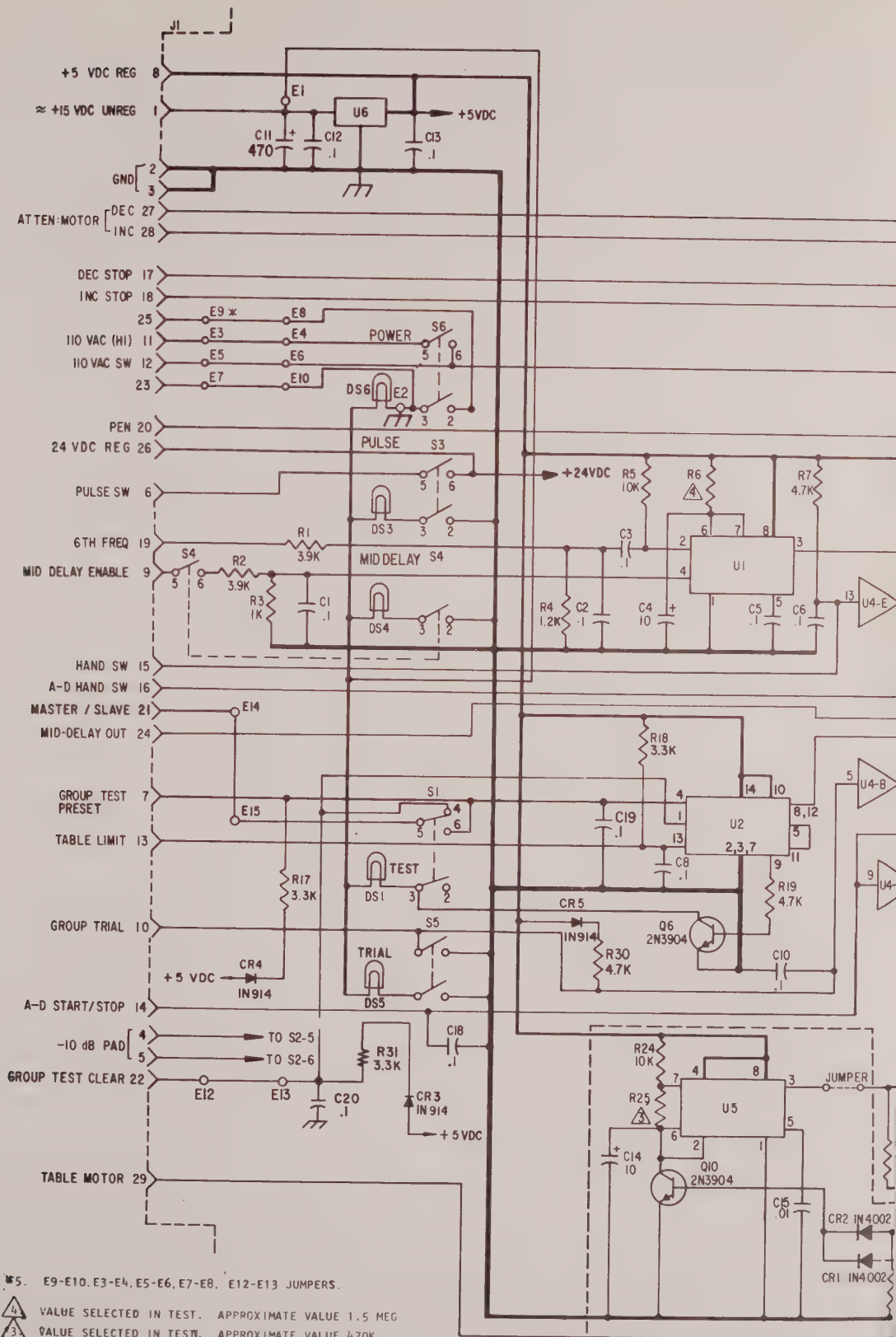
TSTR PIN CONFIG: BOTTOM VIEW

| IC | CHART    |
|----|----------|
| U1 | LM301AN  |
| U2 |          |
| U3 |          |
| U4 | CD4011AE |
| U5 | μA7824   |

## NOTES

1. UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE 1/4 W, ±5% TOL WITH VALUES IN OHMS. CAPACITOR VALUES ARE IN MICROFARADS.
2. DIODES CR1 THRU CR8 AND CR13 ARE IN914, CR8 THRU CR12 ARE IN4002.
3. LAST REF DESIGNATORS USED ARE: C19, CR13, R62, K8, Q6, U5 AND P1.
4. NOTE DELETED.
- \*5. ADJUST C<sub>2</sub> FOR 8000 Hz ± 3%.
- △6. MAY BE SELECTED FOR CORRECT RISE & FALL TIME AND PULSE RATE.
- △△7. VI MAY BE REPLACED WITH TRACOR P/N 76379-0005 (OPTIONAL) FOR CORRECT RISE AND FALL TIME.

Figure 10 Diagram Schematic,  
Audio PCB ARJ-4C  
Dwg. No. 19473G



\*5. E9-E10, E3-E4, E5-E6, E7-E8, E12-E13 JUMPERS.

4. VALUE SELECTED IN TEST. APPROXIMATE VALUE 1.5 MEG

3. VALUE SELECTED IN TEST. APPROXIMATE VALUE 470K

2. LAST REFERENCE DESIGNATOR USED: R51, R21, R20, U6, J1, V3, CR2

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE 1/4 WATT, ± 5% TOLERANCE, WITH VALUES IN OHMS; CAPACITOR VALUES ARE IN MICROFARADS

NOTES:

SLOW RESPONSE OPTION 19546-0002

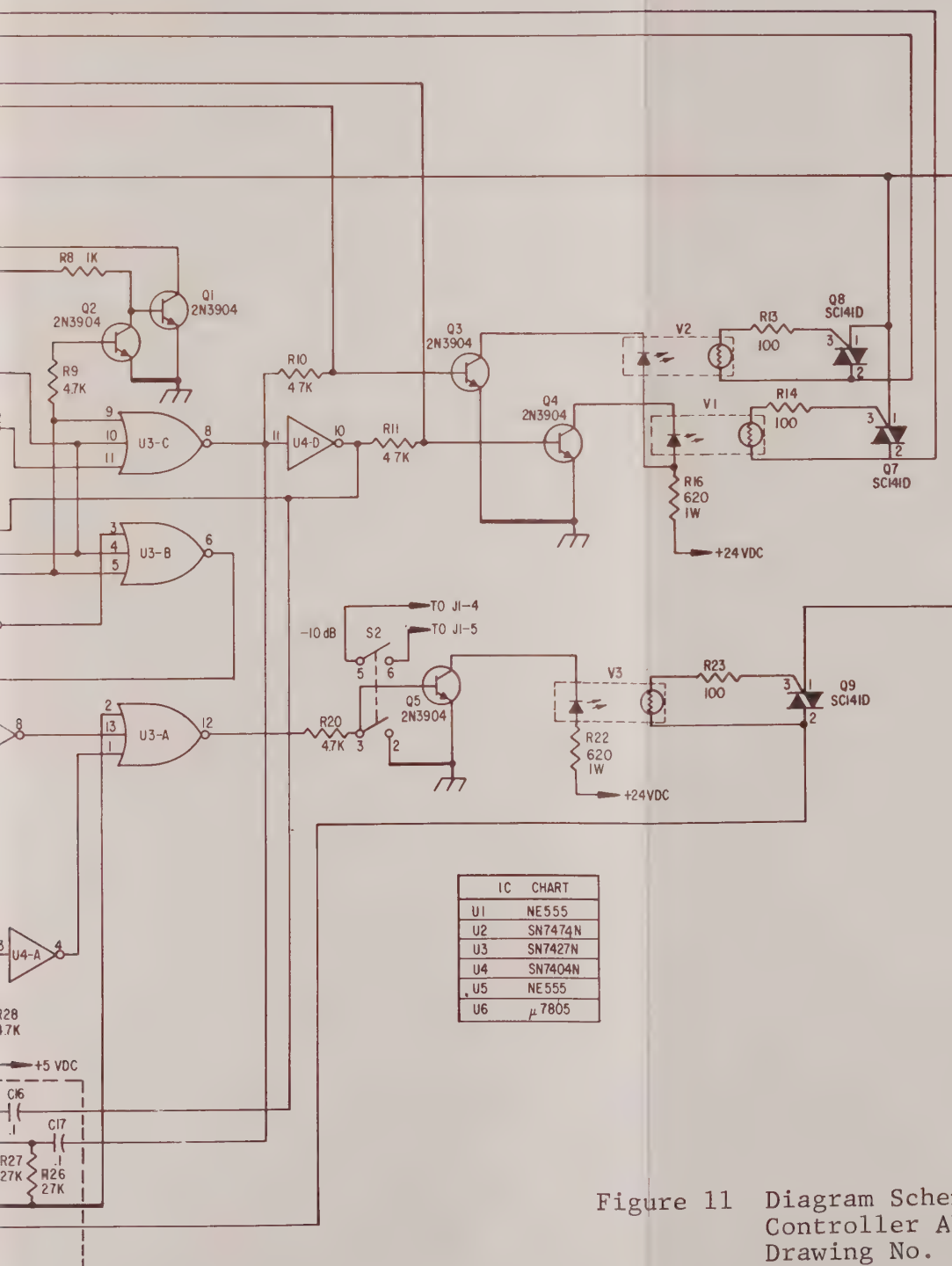
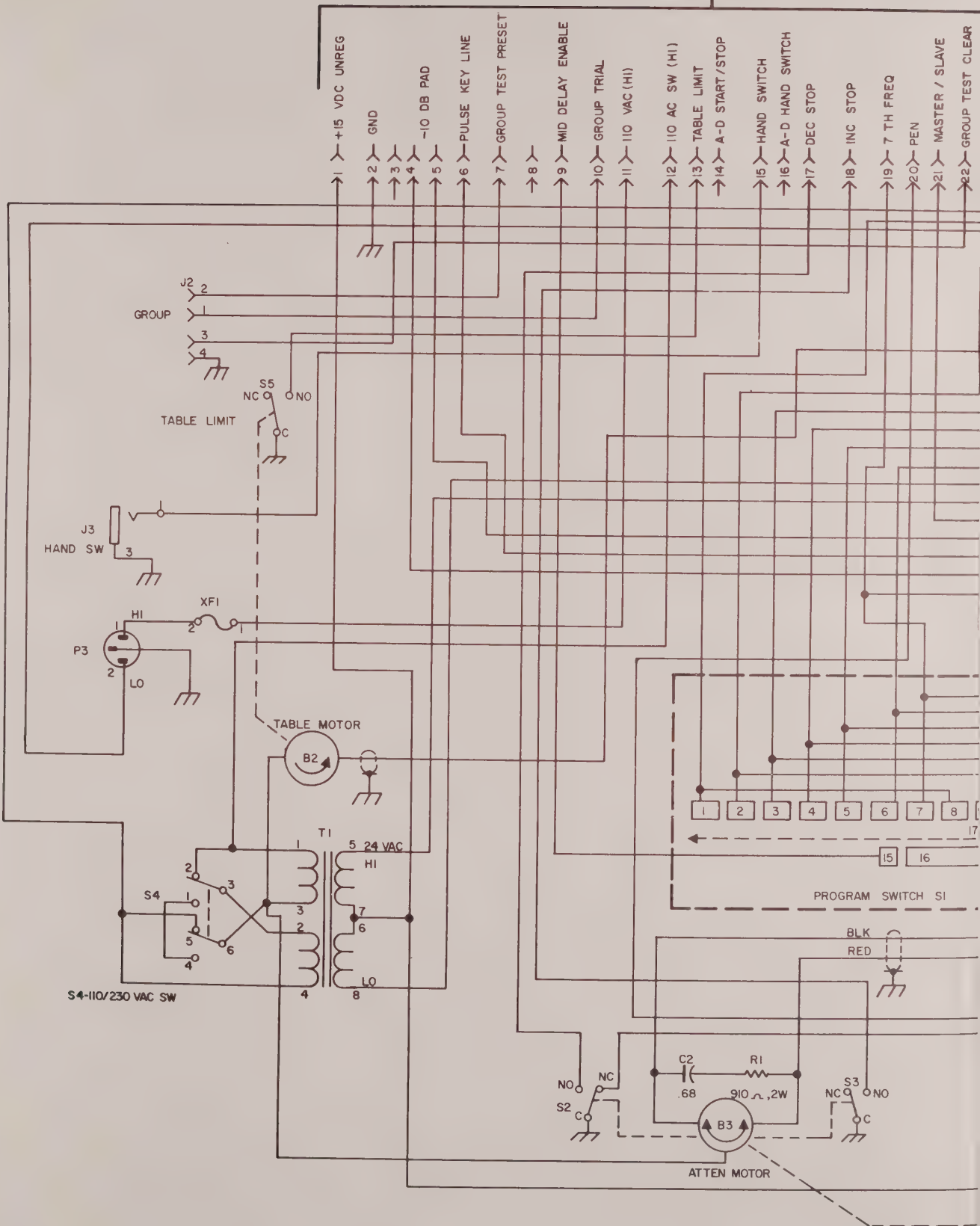


Figure 11 Diagram Schematic - Function Controller ARJ-4C, Drawing No. 19547N



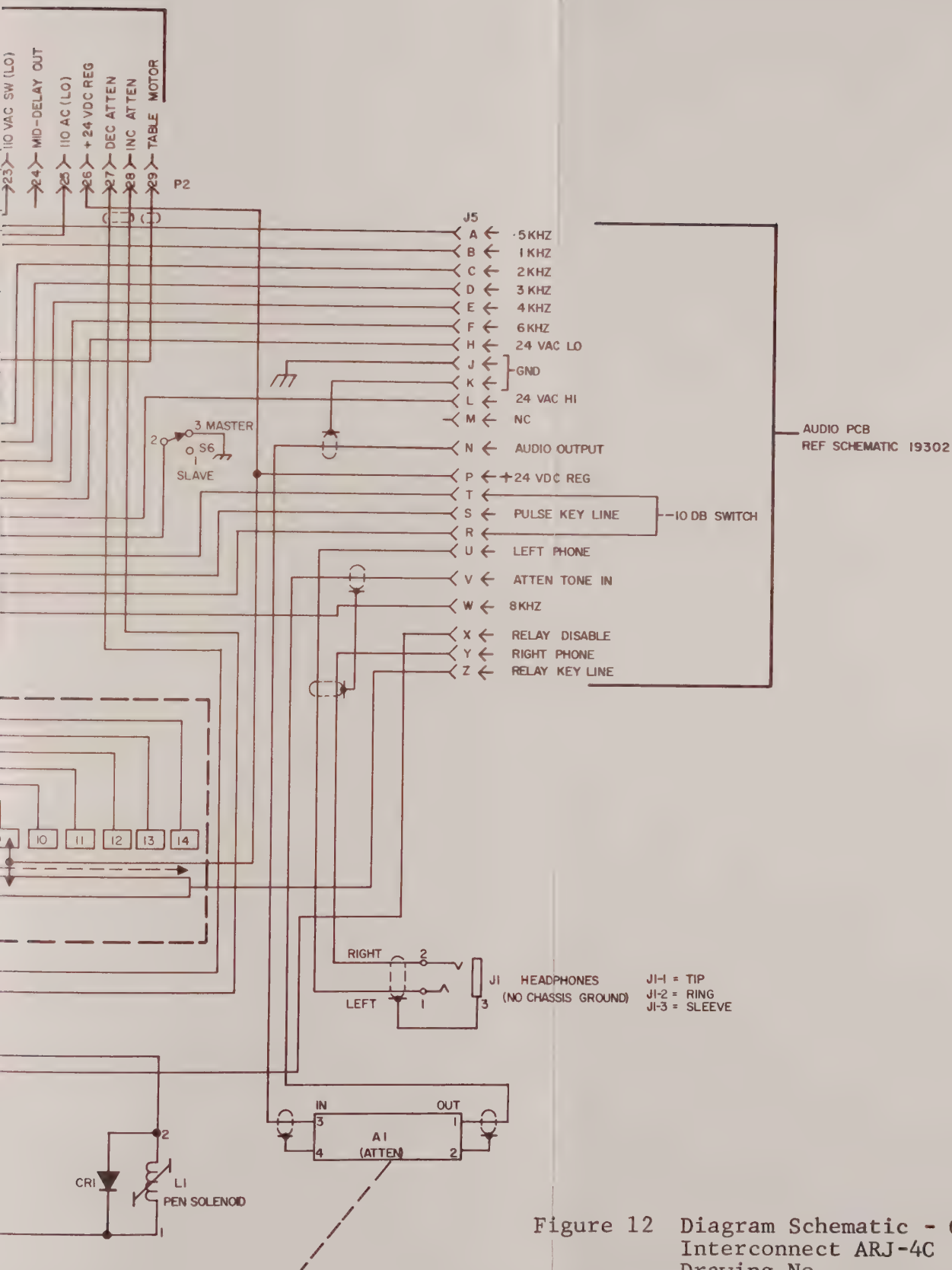
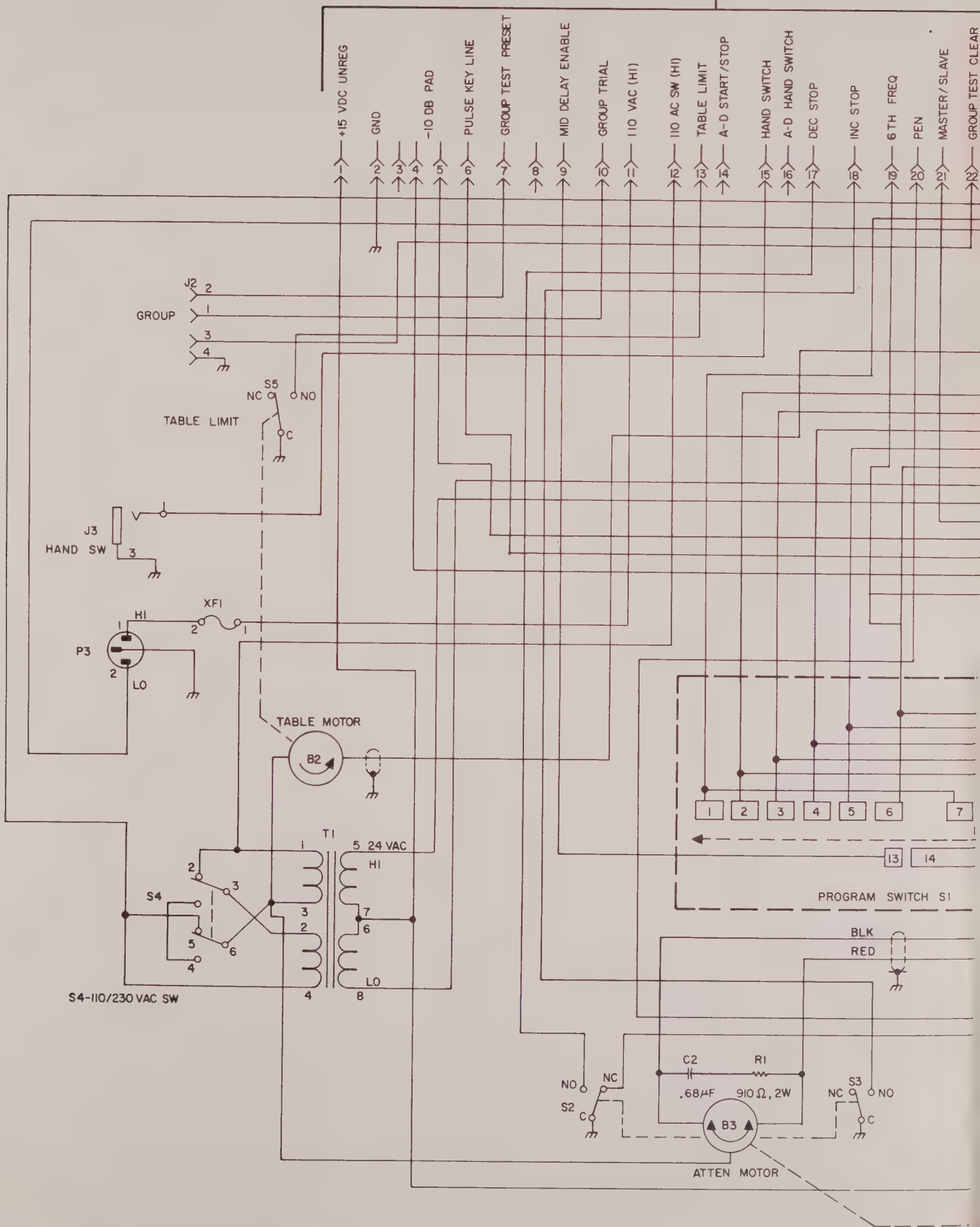


Figure 12 Diagram Schematic - Chassis Interconnect ARJ-4C Drawing No. 19548F



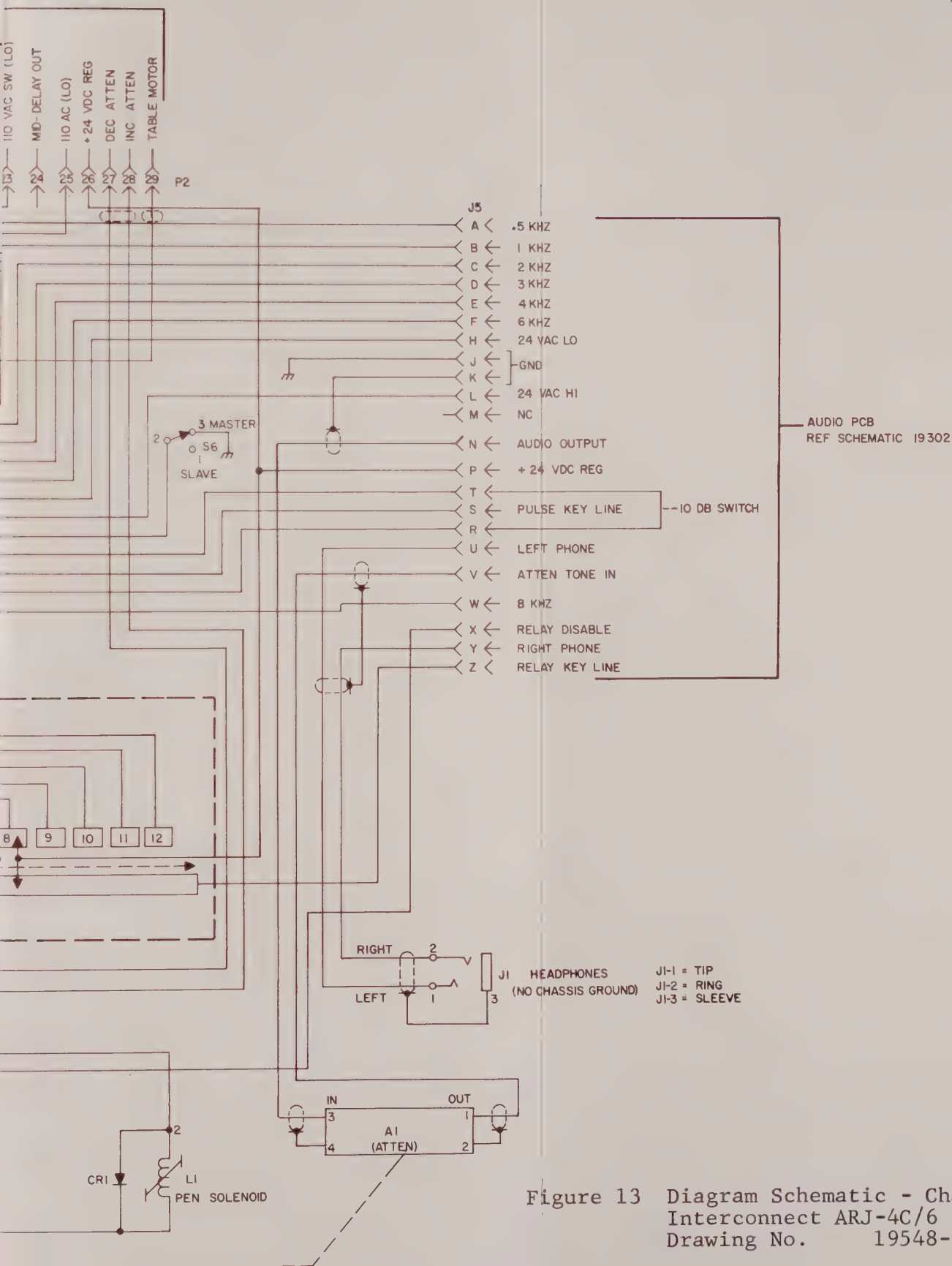


Figure 13 Diagram Schematic - Chassis Interconnect ARJ-4C/6  
Drawing No. 19548-0002-

## READER'S COMMENTS

Your comments regarding this manual will help us improve future editions. Please comment on the usefulness and readability of the manual, suggest additions and deletions, and list specific errors and omissions.

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MANUAL NUMBER \_\_\_\_\_ REV \_\_\_\_\_

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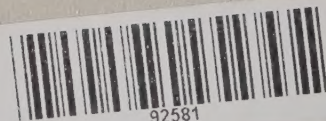
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Western Acoustics

Bill Van Cleave

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